Regional Operational Plan SF.1J.2019.05

Operational Plan: Southeast Alaska Marine Boat Sport Fishery Harvest Studies, 2019

by

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May 2019

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$log_{2,}$ etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

REGIONAL OPERATIONAL PLAN SF.1J.2019.05

SOUTHEAST ALASKA MARINE BOAT SPORT FISHERY HARVEST STUDIES, 2019

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This document should be cited as follows:
Jaenicke, M., D. Tersteeg, and J. Huang. 2019. Operational Plan: Southeast Alaska marine boat sport fishery harvest studies, 2019. Alaska Department of Fish and Game, Regional Operational Plan SF.1J.2019.05, Anchorage.

SIGNATURE/TITLE PAGE

Project Title:	Southeast Alaska marine boat sport fishery harvest studies, 2019
Project leader(s):	Mike Jaenicke, Fishery Biologist III
Division, Region and Area	Division of Sport Fish, Region I, Douglas
Project Nomenclature:	Project F-10-34, F-10-35 Study S Job 1-1: Federal Aid in Sport Fish Restoration; General Fund; NOAA LOA; PSC NF
Period Covered	April 20, 2019–March 31, 2020
Field Dates:	April 29, 2019–September 15, 2019
Plan Type:	Category III

Approval

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ABSTRACT

Marine boat sport anglers throughout Southeast Alaska target and harvest Chinook salmon *Oncorhynchus tshawytscha*, coho salmon *O. kisutch*, Pacific halibut *Hippoglossus stenolepis*, lingcod *Ophiodon elongatus*, a variety of rockfish species *Sebastes spp*., and sablefish *Anoploploma fimbria* primarily during April to September. Angler effort, catch, and harvest data will be collected from late April to early September from returning marine boat anglers at the following ports: Yakutat, Elfin Cove, Gustavus, Juneau, Sitka, Petersburg, Wrangell, Ketchikan, Craig, and Klawock. Harvest sampling will be used to collect biological samples and associated data to estimate the age, length, and genetic composition of the Chinook salmon harvest, and Chinook and coho salmon will be inspected for missing adipose fins, indicating the head should be removed to recover a coded wire tag. Contributions of hatchery and wild coded-wire-tagged stocks (both Chinook and coho salmon) to the sport harvest will be estimated for all sampled ports, and the wild mature component of the Chinook salmon harvest in Division of Commercial Fisheries Salmon District 108 (Petersburg-Wrangell) and District 111 (Juneau) will also be estimated. Biological data from harvested Pacific halibut (lengths), lingcod (lengths and sex), and rockfish (lengths) will be collected from guided and unguided marine boat anglers. The length data will be converted via established species-specific, length-weight relationships to estimate average weights by species and angler type.

Key words: Marine boat sport fishery, creel survey, angler effort and harvest, guided angler, unguided angler, age composition, length-at-age, length, weight-length conversion, average weight, coded wire tag, hatchery stocks, wild stocks, Salmon District 108, Salmon District 111, Chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *Oncorhynchus kisutch*, Pacific halibut, *Hippoglossus stenolepis*, lingcod, *Ophiodon elongatus*, sablefish, *Anoplopoma fimbria*, rockfish species, *Sebastes*, Yakutat, Elfin Cove, Gustavus, Juneau, Sitka, Petersburg, Wrangell, Ketchikan, Craig, Klawock

PURPOSE

The purpose of this project is to characterize the harvest of multiple species of fish in the Southeast Alaska (SEAK) marine recreational (sport) fishery. This project, implemented by the Alaska Department of Fish and Game (ADF&G) and known as the Marine Harvest Studies (MHS) Project, provides preliminary estimates of the harvest of Chinook salmon *Oncorhynchus tshawytscha*, coho salmon *O. kisutch*, Pacific halibut *Hippoglossus stenolepis*, rockfish *Sebastes spp.*, and lingcod *Ophiodon elongatus* by the marine boat sport fisheries in SEAK. The MHS Project differs from the ADF&G Statewide Harvest Survey (SWHS)[1] and the ADF&G Saltwater Charter Vessel Logbook (SCVL)[2] programs in that it collects coded wire tag (CWT) information from Chinook and coho salmon and biological data from all focal species. It also allows for inseason and postseason preliminary estimates that are available sooner than provided through the SWHS or the SCVL.

The information needed for managing these fisheries requires the collective reporting of the SWHS and SCVL to be integrated with on-site sampling of the select characteristics of each fishery, such as obtaining lengths of Pacific halibut, collecting CWTs from Chinook and coho salmon, and identifying rockfish species composition, in addition to a number of other parameters associated with these species as well as for lingcod and sablefish *Anoplopoma fimbria*. Although the SWHS provides the authoritative total estimates of the harvest and catch of the corresponding sport fisheries, it was not designed to capture biological information such as length or weight information, identifying the presence of CWTs, or providing species composition data for rockfish species. The SCVL—similarly—does not capture numerous biological aspects of the sport

[1] The annual statewide mail survey of licensed sport anglers in Alaska conducted by ADF&G, Division of Sport Fish. Statewide Harvest Survey (SWHS) estimates from the Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK are available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

[2] Estimates from this program are kept in the Saltwater Logbook Database (Alaska Department of Fish and Game, Division of Sport Fish. [Internet] 2006 to present. URL not publicly available as some information is confidential. Contact Research and Technical Services for data requests.

fisheries catch and harvest that is obtained through on-site sampling available through the MHS project. The general study design for this project allows estimated proportions or averages of the specific elements of each fishery to be made (e.g., proportion of the harvest of Chinook salmon that are from Alaskan hatchery production); these proportions and averages can be applied to the corresponding harvest estimates from the SWHS to generate information useful for management of these fisheries.

The harvest estimates from the annual mail-out survey of licensed sport anglers in Alaska (SWHS) does not release final estimates for any year until sometime after June the following year. Final data from the SCVL is similarly only available during the next calendar year, although preliminary information can be obtained in-season upon request. The MHS project will provide preliminary projections of the final estimates that will be derived following the publication of the annual SWHS mail survey harvest estimates from the prior year. The projections are calculated by multiplying observed catch and harvest in each sampled port by an expansion factor for each SWHS area (expansion factors are derived from the ratios of past final SWHS estimates and observed on-site statistics).

BACKGROUND

The Southeast Alaska sport fisheries are diverse, and effort is mostly concentrated around the major communities of Juneau, Ketchikan, Sitka, Wrangell, and Petersburg (Schwan 1984, Suchanek et al. 2002). Substantial effort is also expended near remote fishing lodges and smaller communities throughout the region such as Craig-Klawock, Gustavus, Elfin Cove, and Yakutat. The data needs and impetus for management varies for each of the species across the region, often geographically and temporally.

The approach is to survey sport anglers and sample their catches at primary access points such as harbors and boat launches and use these data together with the SWHS to estimate desired parameters. For example, relative to Chinook salmon the state has an obligation to estimate the contribution of hatchery and wild stocks originating from Southeast Alaska, Canada, and the Pacific Northwest under the US/Canada Pacific Salmon Treaty (Public Law 99-5), so identification of coded wired tags (CWT) is critical. The sport charter harvest of Pacific halibut is managed under a guideline harvest level (GHL) adopted by the North Pacific Fisheries Management Council (NPFMC) and port sampling provides essential data on lengths and average weights needed for estimating harvested biomass by guided and unguided fishers. Harvest per unit effort (HPUE) for coho salmon in the Juneau and Ketchikan marine sport fisheries is used to monitor the relative abundance and movement of coho salmon to inside waters from early June to September depending on the strength of the run, and the Juneau HPUE is specifically cited in 5 AAC 29.110 (Management of Coho Salmon Troll Fishery).

This operational plan documents the study design, sample size goals, sampling schedules, data collection, and recording protocols to be implemented for the MHS Project.

CHINOOK SALMON

The Alaska Board of Fisheries (BOF) continues to allocate 20% of the combined commercial troll and sport U.S.–Canada Pacific Salmon Treaty catch quota for Chinook salmon to the Southeast Alaska sport fishery.

A preliminary estimate of the annual Southeast Alaska Pacific Salmon Treaty Chinook salmon sport harvest (hereafter referred to as the "Pacific Salmon Treaty harvest") from onsite survey data collected by this project will be provided to the Pacific Salmon Commission in October of the year of the estimate as a preliminary number for accounting purposes. The Pacific Salmon Treaty harvest is defined as the total Chinook salmon harvest, minus harvest of Alaska hatchery fish. Additionally, estimates will be made of preliminary contributions by CWT fish from Alaska and non-Alaska hatcheries, as well as for a few tagged wild stocks that are within the scope of this project.

Data useful for management of Chinook salmon stocks in specific areas of SEAK will also be collected. For example, managers for the Taku River and Stikine River fisheries use inseason harvest information to monitor the return of Chinook salmon to these transboundary rivers. Accordingly, weekly estimates of the Pacific Salmon Treaty harvest will be estimated by this project for Alaska Department of Fish and Game (ADF&G), Division of Commercial Fisheries (CF) Salmon District 108 in the Petersburg-Wrangell area, associated with the Stikine River, and District 111 in the Juneau area (Figure 1), associated with the Taku River. Henceforth, throughout this operational plan, these 2 districts will be referred to as CF Salmon Districts 108 and 111, respectively.

In addition, data on the age composition of Chinook salmon harvests collected in the spring in Juneau, Ketchikan, Petersburg, and Wrangell will be gathered for sibling models used in projections for stocks associated with the Pacific Salmon Treaty and others.

The genetic stock identification of Chinook salmon harvested by the various sport and commercial fisheries in Southeast Alaska is a management tool being evaluated by the Pacific Salmon Commission. Accordingly, genetic samples will be collected in a number of fisheries to address this evaluation. Additionally, heads will be collected from Chinook salmon harvested in the Sitka and Craig-Klawock area for otoliths related to this stock identification effort. After the genetic origin of these outer coast fish is determined, their scales will be aged by each respective state or provincial fishery management agency.

COHO SALMON

Estimates of Alaska hatchery contributions for coho salmon harvested in the sport fisheries in Juneau, Ketchikan, Sitka, Craig-Klawock, Petersburg, Wrangell, Gustavus, Elfin Cove, and Yakutat will be generated by this project and used for evaluation of enhancement projects. Additionally, recovery of tagged indicator stocks of wild coho salmon may be expected—especially in the Juneau fishery—from wild stock tagging programs occurring at Auke Creek, and the Taku and Berners river drainages. Additional tagging projects occurring in the Hugh Smith drainage (southern SEAK, mainland) and Ford Arm drainage (northern SEAK, Chichagof Island) will probably include recovery of coho salmon from the Ketchikan and Sitka fisheries, given their proximity to these tagging locations.

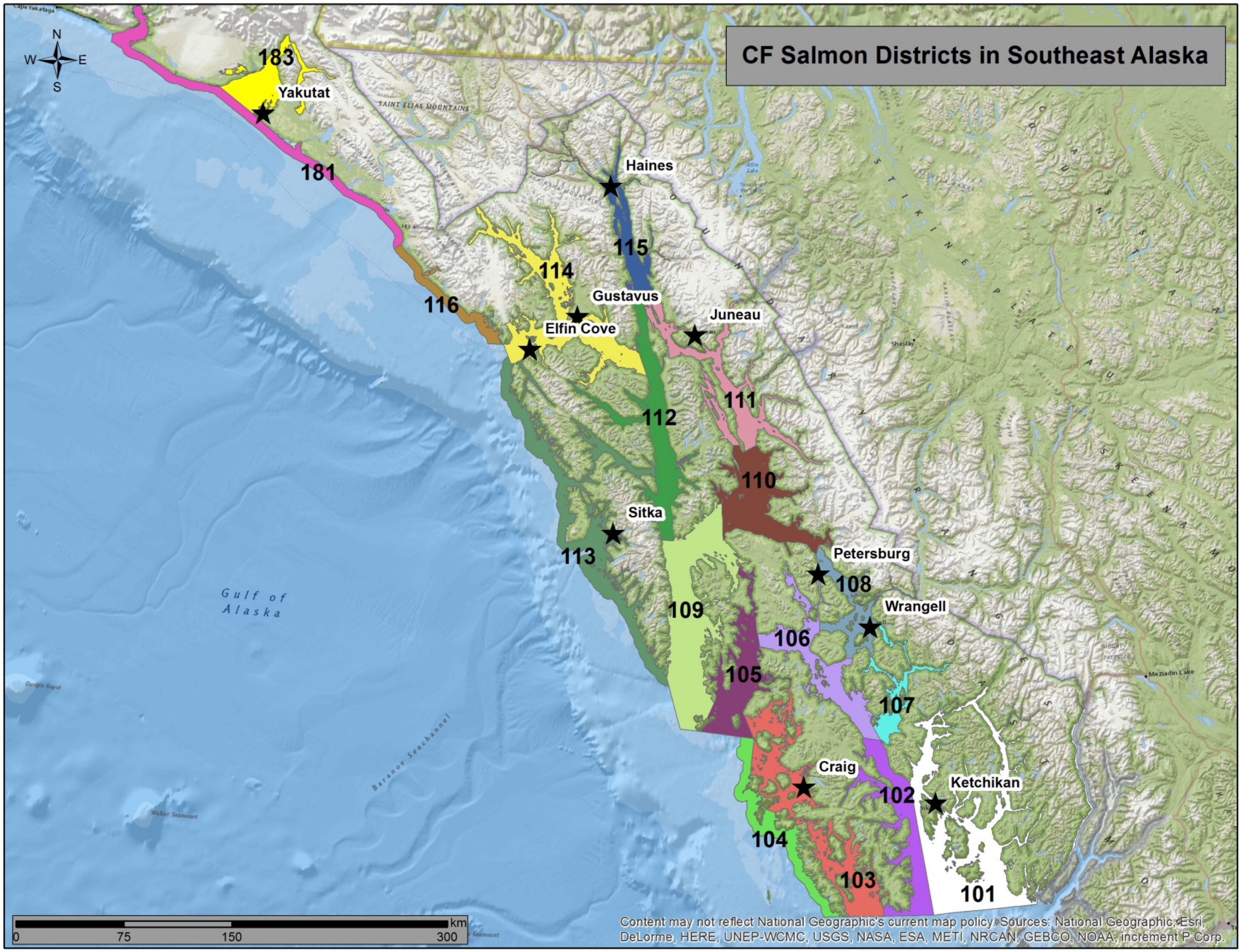

Figure 1.–Delineation of Division of Commercial Fisheries salmon districts in Southeast Alaska.

HALIBUT

Sport charter harvest of Pacific halibut is managed under a Catch Sharing Plan (CSP) adopted by the North Pacific Fishery Management Council (NPFMC) in October 2012 and which went into effect on 13 January 2014. Prior to this, the fishery was managed under a Guideline Harvest Level (GHL). Under the new CSP, charter businesses can lease commercial individual fishing quota (IFQ) as guided angler fish (GAF) to allow their guided anglers to harvest halibut under private regulations.

Average weights of Pacific halibut in the sport harvest are needed to estimate removals in weight units for purposes of stock assessment and management. Estimates of fishery parameters obtained by this project will be used by Division of Sport Fish, Research and Technical Services staff for estimation and projection of Southeast Alaska sport harvest as described in Meyer (2014). The project described in Meyer (2014) will combine the average weights for both components of the fishery (guided and unguided) from the on-site sampling project described herein with estimates from the SWHS and logbooks to obtain estimates and projections of sport halibut removals in biomass units for both the NPFMC and the International Pacific Halibut Commission (IPHC). Additionally, release information for halibut will be provided to the statewide sport fish bottomfish coordinator for use in estimating total mortalities. These data will be utilized to help assess the performance of the current "reverse slot limit [3] size restrictions" while simultaneously addressing contemporary assumptions about halibut discard mortality rates in the Southeast Alaska halibut sport fishery. Finally, the proportion of unguided halibut harvest that occurs prior to the mean IPHC survey date will also be provided as requested by the IPHC.

ROCKFISH

The recreational fishery for demersal shelf rockfish (DSR) is managed by ADF&G under allocations determined in regulation 5 AAC 28.160 as a percentage of the total allowable catch (TAC) approved by the NPFMC annually. Therefore, this project will estimate species composition and average weights of the sport harvest for the NPFMC using species-specific length-weight relationships. The 7 DSR species are yelloweye *Sebastes ruberrimus*, quillback *S. maliger*, copper *S. caurinus*, canary *S. pinniger*, tiger *S. nigrocinctus*, China *S. nebulosus*, and rosethorn *S. helvomaculatus* rockfish. Numbers of DSR released will also be recorded by species to estimate release mortality. Estimates of species composition, average weight, discard mortality rate (from literature), number of fish released, of particular species and species groupings will be combined with SCVL and SWHS harvest information to obtain estimates of the biomass for the sport fishery in outside waters of SEAK.

Additionally, species composition of the rockfish harvest in all ports will be estimated and an estimate of the percent of change from previous years of the number of yelloweye rockfish harvested by the beginning of August in the ports of Sitka, Ketchikan, Craig-Klawock, Gustavus, Elfin Cove, and Yakutat will be obtained for inseason management purposes.

Since the 2013 season the release of rockfish at depth has been mandatory for guided anglers. This project will assess the proportion of *unguided* anglers currently utilizing deepwater release devices when releasing rockfish. In addition to providing bottomfish managers and researchers with an

[3] Under a reverse slot limit, anglers are allowed to retain fish that are smaller than or larger than the slot, not within. For 2019, the lower and upper bounds of the reverse slot limit are 38 inches and 80 inches, respectively for guided anglers.

estimate of current use, it will allow ADF&G personnel to provide anglers with information about the use of release devices.

LINGCOD

This project will calculate average weights and total harvest biomass of lingcod by the sport fishery in SEAK. Sport harvests (in numbers) of lingcod will continue to be estimated by the SWHS, but stocks are managed by the estimated total biomass of the sport harvest in relation to lingcod management area quotas. Therefore, methods to estimate the average round weight of lingcod harvested in the following sport fisheries will be estimated: Craig-Klawock, Ketchikan, Sitka, Gustavus, Elfin Cove, and Yakutat. The average weight estimates will be combined with projections of the total harvest from the SWHS to obtain preliminary estimates of the biomass of removals of lingcod for the fisheries of concern. Once the final SWHS estimate is available, the finalized biomass estimate will be calculated and reported to the BOF and ADF&G, DCF.

SABLEFISH

The sablefish sport harvest is relatively small compared to other species sport harvested in the region. However, some stocks of sablefish exploited by multiple Southeast Alaska fisheries may need to be managed conservatively. Accordingly, when sablefish are observed by this project, they will be measured for length and their harvest and released numbers recorded as an index of catch rates or sampling levels. When sample sizes are adequate, length data will be used to estimate average weight in the sport harvest. Average weight is needed to express sport harvest estimates in terms of biomass. These estimates will be provided to the National Marine Fisheries Service for catch accounting and assessment. Sablefish estimates for commercial fishery groundfish area NSEI will be provided to Andrew Olson with DCF.

RELEASED FISH

The numbers of released Chinook salmon (for both large and small categories), halibut, lingcod, sablefish, and rockfish by species or by species grouping will be recorded during angler interviews.

OBJECTIVES

PRIMARY OBJECTIVES

Unless otherwise stated, the objectives for each port in the MHS Project identified below are for all ports separately for the stated duration in Table 1.

Table 1.–Port location, survey duration, and list of primary objectives addressed by sampling in each port in Southeast Alaska for 2019.

	2019		
Port	Start date	End date	Primary Objectives by port
Juneau	06 May	15 Sep	1–3
Sitka, Ketchikan	29 Apr	15 Sep	1-5 (and 6 for Sitka)
Petersburg, Wrangell	29 Apr	01 Sep	1-3
Craig-Klawock, Yakutat	29 April	01 Sep	1-5
Elfin Cove, Gustavus	06 May	01Sep	1-5

The primary objectives for the 2019 MHS Project are as follows:

1) Estimate the preliminary yearly values [4] of the following characteristics of the Chinook salmon harvest:
    a) Total sport harvest, total Alaska hatchery and total non-Alaska hatchery contributions: such that the estimates are within 50 - 90% of the true values 90% of the time for each port (as identified in Appendix A1, A2, and A3)
    b) Relative Alaska hatchery and relative non-Alaska hatchery contributions: such that the estimates are within 5 – 25 percentage points of the true value 90% of the time for each port (as identified in Appendix A1, A2, and A3).
2) Estimate the preliminary yearly values of the following characteristics of the coho salmon harvest:
    a. Total sport harvest, total Alaska hatchery and total non-Alaska hatchery contributions: such that the estimates are within 50 100%of the true values 90% of the time for each port (as identified in Appendix A1, A2, and A3)
    b. Relative Alaska hatchery and relative non-Alaska hatchery contributions: such that the estimates are within 5 – 25 percentage points of the true value 90% of the time for each port (as identified in Appendix A1, A2, and A3)
3) Estimate the average net weight of the harvest of Pacific halibut by guided and unguided anglers at each port, such that the estimate is within 20 - 40% of the true value 90% of the time for each user group at each port (as identified in Appendix A4).
4) Estimate the average weight of the sport harvest of lingcod by guided and unguided anglers in Sitka, Ketchikan, Craig/Klawock, Gustavus, Elfin Cove, and Yakutat, such that the estimated average weight of the harvest at each port is:
    a) Within 20% - 50% of the true value 80% of the time for the harvest by unguided anglers (as identified in Appendix A5), and
    b) Within 20% of the true value 90% of the time for the harvest by guided anglers (Appendix A5)
5) Estimate the preliminary values of the average weight of harvested rockfish by species and species grouping and by guide status (guided or unguided) at each port, such that the estimated average weight of the harvest is within 20% - 40% of the true value 90% of the time (as identified in appendices A6 – A14).
6) Estimate the age, sex, and length composition of the black rockfish landed at Sitka during May through September such that the relative precision of the estimated length is within 5% of the true value 95% of the time, and the estimated age, sex proportions are within 10 percentage points of the true value 95% of the time for guided and unguided anglers (Appendix A15).

SECONDARY OBJECTIVES

In addition to meeting the primary objectives listed above, there are several secondary objectives that will address additional management needs. The secondary objectives for 2019 are as follows:

[4] Estimated yearly values are preliminary until final estimates are derived following the publication of the annual SWHS mail survey harvest estimates.

1) Estimate the early season (late April to mid-July) Pacific Salmon Treaty harvest of Chinook salmon for Commercial CF Salmon Districts 108 (Petersburg/-Wrangell) and 111 (Juneau) (Figure 1).
2) Collect genetic tissue samples (pelvic fin clips) and corresponding age structures (scales) from Chinook salmon proportional to the harvest at all sampled ports and provide the proportion of the observed harvest sampled each week to the ADF&G, CF Gene Conservation Laboratory. In addition, the corresponding heads from the sampled Chinook salmon will be collected in Sitka and Craig-Klawock (Craig and Klawock collectively compose the Prince of Wales area) for stock identification purposes (via otoliths).
3) At all ports, sample every adipose-fin clipped Chinook and coho salmon encountered with handheld tag detection wands (wands, hereafter) to identify 'no-tag' fish (those Chinook and coho salmon adipose-fin clipped but without a CWT) to increase CWT recovery efficiency.
4) At all ports, sample 10% of the adipose-intact Chinook salmon encountered with wands to identify the presence of double index tags (DITs).
5) Report postseason the observed weekly harvest per unit effort (HPUE) of Chinook, coho, chum *O. keta*, and pink salmon *O. gorbuscha*, and Pacific halibut by port.
6) Estimate the length compositions of Pacific halibut harvested by guided and unguided anglers at all sampled ports and report these to the IPHC as requested.
7) Estimate the proportion of released Pacific halibut in IPHC area 2C within each of the following length categories: (a) length $\leq$ L, (b) length > L and < U, or (c) length $\geq$ U, where L and U indicate the lower and upper limits of the reverse slot size limit.
8) Estimate the proportion of the Pacific halibut harvest by unguided anglers prior to the mean IPHC survey date[5], such that the precision is within 20 percentage points of the true value 90% of the time.
9) Estimate the preliminary biomass of the sport harvest of lingcod by guided and unguided anglers in Sitka, Ketchikan, Craig/Klawock, Gustavus, Elfin Cove, and Yakutat.
10) Project the yearly preliminary harvests of lingcod and yelloweye rockfish by early August in the ports of Sitka, Ketchikan, Craig-Klawock, Gustavus, Elfin Cove, and Yakutat[6].
11) Measure lengths from sablefish observed during interviews at all surveyed ports and track the catch (i.e., harvest and release) of sablefish in the Southeast Alaska sport fishery.
12) Estimate the preliminary values of the following characteristics of the rockfish harvest:
    a) biomass of total sport removals (harvest and release mortality) for demersal shelf rockfish from the Southeast Outside District (Craig-Klawock, Sitka, Gustavus, Elfin Cove, and Yakutat combined) for each user group (guided and unguided).
    b) species composition for all rockfish harvested by guided and unguided anglers at each port.
13) Estimate the proportion of unguided boat trips that utilize deepwater release devices in the release of at least one rockfish, if rockfish were released on the trip.

[5] Each year the IPHC conducts a longline survey of the Pacific halibut stock. The survey utilizes stations in IPHC Area 2C and 3A. Harvest that occurs prior to the survey has the potential to affect the survey catch. Therefore, the IPHC annually requests estimates of the proportions of noncharter harvest that occurred prior to the average survey date. These estimates, along with similar estimates from the commercial fishery, are used to standardize the longline survey abundance index to account for variation in the amount of harvest prior to the mean date of the survey.

[6] Preliminary estimates of the percent change in harvest of lingcod and yelloweye rockfish in the noted ports from the previous year will be calculated by combining separate estimates for the guided and unguided components of the fishery; these estimates will be utilized for inseason management purposes.

14) Estimate the proportion of the catch of Chinook salmon (both <28 inches: small and ≥28 inches: large), rockfish (yelloweye, other DSR, slope, and pelagic rockfish), halibut, and lingcod that were released, by species or species grouping.

METHODS

The goal of this project is to collect biological and catch, harvest, and effort information from the marine boat sport fishery. The SWHS also collects catch, harvest, and effort information. SWHS harvest estimates are generally bigger than the estimates produced by the MHS project and they are considered to be the final numbers for harvest, although they take up to a year to be finalized. In the interim the harvest numbers produced by this project using a 4-stage design are used in conjunction with a 5-year moving average expansions between the two programs to produce a preliminary estimate. The variance around the preliminary estimates of harvest produced by using the expansion between this project and the SWHS rely not only on this project but on the uncertainty of estimates from the SWHS. The variance around biological information not related to harvest, such as average weight, relies solely on this project.

Procedures for obtaining estimates associated with each of the study objectives will be similar for each of the surveyed locations. The following sections detail the procedures that are common to multiple survey areas. Site-specific differences in procedures are outlined in later sections of this operational plan.

STUDY DESIGN

The general approach for collecting the information necessary to achieve the objectives for this project involves sampling boat parties as they exit the fishery at major harbors and boat ramps at each of the ports selected for surveying. The specific harbors and boat ramps selected for survey represent the majority of the harvest at a particular port[7]. The exclusion of less frequently used access locations should have minimal influence on the inference to the total fishery because they represent only a small portion of the fishery. In some instances, locations with relatively minor use by the fishery were included for sampling when these lower-use locations represent components of the fishing public that may be otherwise unrepresented by sampling only the heavier-use locations (e.g., Starrigavan boat launch in Sitka; although it is a low-use access location, it is primarily used by unguided anglers and may be periodically sampled to achieve adequate samples from that component of the fishery).

The days of the week and periods of time selected for surveying were similarly restricted to those periods wherein the majority of sport boats exit the fishery (determined from historical creel or catch sampling surveys). Because relative use by guided versus unguided segments of each fishery differs during the week (e.g., there is more weekend use by unguided anglers), and within the fishing day (e.g., some guides time their fishing trips related to cruise boat schedules), all parameters of interest must be estimated separately for each of these components of the fishery.

As noted above, the general study design approach for this project is to estimate proportions or averages of the specific elements of each fishery (e.g., proportion of the harvest of Chinook salmon that are from Alaskan hatchery production) and apply these proportions and averages to the corresponding estimate from the SWHS. The information necessary for estimating these

[7] It is recognized that some portion of the harvest returning to private docks or lodges goes unsampled due to an inability to access private property.

proportions will be gathered by measuring characteristics of the catch from intercepted boat parties at the sampled harbors and boat launches. At all ports, "creel technicians" conduct complete interviews, which include gathering information from each intercepted boat party on: effort, harvest and catch, logbook information (if fishing from a registered guide boat), and biological information. During all interviews, the technicians also record information on the number of exiting boat parties, which is used in the estimation process described below. In some instances, the parameter of interest is the magnitude of the harvest or the numbers of fish released by species or species group (e.g., Primary Objective 1a: yearly preliminary estimate of total sport harvest of Chinook salmon). The necessary information to address those needs is also incorporated into the study design (see Data Analysis section for further details).

In Ketchikan, Sitka, and Craig-Klawock, 1 or more "catch technicians" will concentrate their efforts on sampling biological information for salmon and groundfish species. Catch technicians in Sitka and Craig-Klawock will also concentrate on collecting Chinook salmon otolith samples. Catch technicians are stationed at the busiest docks at the busiest times in order to maximize the number of available samples. Throughout the rest of the document, when referred to collectively, creel and catch technicians together will be identified as "technicians."

The design for sampling the harvest and catch is a stratified 4-stage cluster sample survey with sampling days across time representing the first-stage sampling units, access locations (i.e., harbors and boat launches) sampled within a selected day representing the second-stage sampling units, boat parties exiting the fishery during each day at each access location representing the third-stage sampling units, and then finally each fish (by species) representing the fourth-stage or "terminal" sampling unit. (Sukhatme et al. (1984: section 8.10 pages 346–351)). To avoid the potential for subsampling bias within a species, whenever a boat party is contacted for sampling, either all or none of the entire bag (harvest) of a particular species will be sampled, unless specified otherwise in the design.

Accuracy is central to our estimates. Since our fisheries are seasonal in nature, we aim to sample proportionally across the season to maintain accuracy, this takes precedence over a particular number to sample as a sampling goal even though a particular number would give a particular precision. Technicians receive personal feedback via their handheld on the proportion of a species they have sampled during a biweek. Proportions of a species to sample (proportional sampling goals) are set before the season starts and take into account 1) the maximum proportion of species that can be sampled of all the fish that are available to sample at a port during the peak of the season by all technicians, 2) relative precision realistically attainable, and 3) how regulation changes may change the numbers of fish that are available for technicians to sample. The proportional sampling goals are recorded in the creel manual for technicians and will change from year to year. Precision for primary objectives can be found in Appendix A.

Harvest estimates will be calculated for each 2-week time stratum (called biweeks). Annual estimates of harvest will be calculated as the sum of the biweekly estimates; the variance of this estimate will be calculated as the sum of the biweekly estimates of variance. Season wide estimates of averages and proportions will be calculated using season wide strata by port (e.g., Ketchikan) and components of the fishery (i.e., guided and unguided).

The sampling unit selection procedures for this survey will not be done as a random probability-based sample survey in the standard sense but are designed to obtain proportional sampling of the angling effort and harvest. Information on the number of exiting boat parties will be recorded at each sampled access location during each sampled day for all technicians and when combined with the numbers of fish by species observed on each sampled boat will provide weighting factors for each sampling stage to address the likelihood that sampling will not be exactly proportional to the harvest of all species at all times. The resulting estimation approach is composed of a 4-stage-weighted-average. (see Data Analysis section for further details).

In order to obtain the “preliminary yearly values” associated with the primary objectives, a prediction of the corresponding SWHS harvest estimate needs to be made for each species by location. In order to do this a moving average of the past 5 years (2013 – 2017, for this 2019 Regional Operational Plan) of ratios between the harvest estimates of this project (denominator) and the SWHS (numerator) multiplied by the current-year estimate of harvest (from the Marine Harvest Studies Project).The preliminary harvest estimate (this year’s harvest index multiplied by the average ratio) is applied to the observed yearly estimated averages or proportions of interest (e.g., relative Alaska hatchery contribution) to obtain the yearly preliminary values. Note that the expansion factors are developed separately for each SWHS survey area (Figure 2) as follows: Ketchikan represents SWHS Area A, Craig-Klawock is Area B, Petersburg and Wrangell make up Area C, Sitka is Area D, Juneau is Area E, Gustavus and Elfin Cove make up Area G, and Yakutat is Area H.

In order to produce regionwide total estimates of harvest (expanding to include the Haines-Skagway SWHS Area F), a similarly derived 5-year average ratio of the total Southeast Alaska estimate from the SWHS to the sum of SWHS estimates for the survey areas represented in our on-site sampling (i.e., Areas A–E, G, and H) will be used to expand to the total for the region.

The following subsections include descriptions of the general estimation approach employed for specific objectives.

Preliminary Yearly Total Sport Harvest of Chinook and Coho Salmon (Primary Objectives 1a, 2a)

The total predicted harvest estimate for each port corresponding to each SWHS area as obtained by the ratio expansion factor approach described above will compose the estimates of the preliminary yearly total harvest of Chinook and coho salmon for each of those areas. Relative precision for these harvest estimates are provided in Appendix A1.

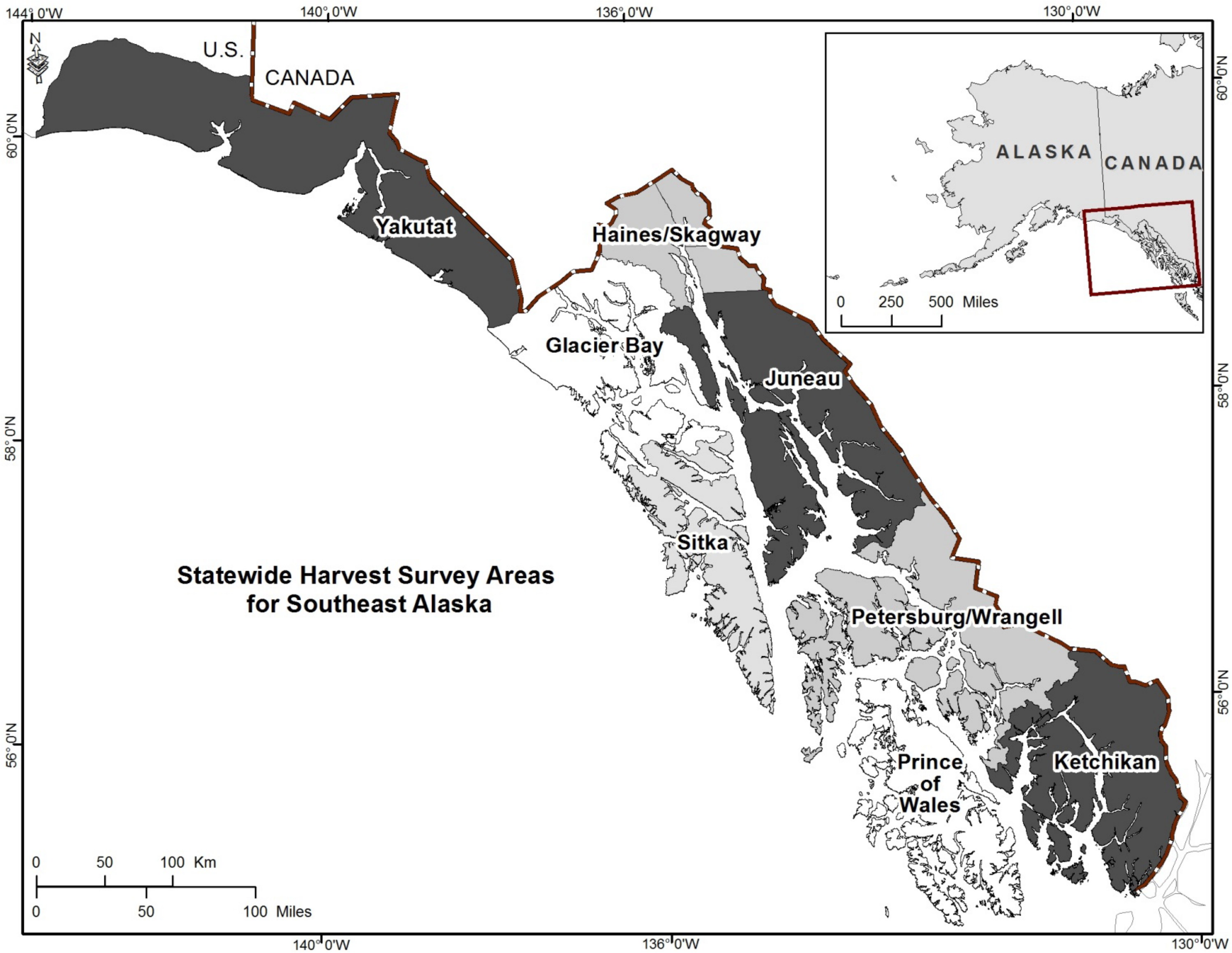

Figure 2.–Delineation of Statewide Harvest Survey (SWHS) areas in Southeast Alaska.

Alaska Hatchery and Non-Alaska Hatchery Contributions for Chinook and Coho Salmon (Primary Objectives 1b and 2b)

Survey technicians will attempt to inspect all harvested Chinook and coho salmon for a missing adipose fin (indicating the possible presence of a CWT). The number of Chinook and coho salmon inspected for adipose finclips will be recorded, and heads from Chinook and coho salmon with adipose finclips will be collected and identified with a uniquely numbered cinch strap. Cinch-strapped heads from Chinook and coho salmon will be forwarded to the ADF&G Mark, Age, and Tag Laboratory (Tag Lab) for eventual dissection, tag removal, and decoding.

Information from the sampling project as well as the coastwide CWT database will be used to estimate the contributions of Alaska hatchery Chinook and coho salmon using an adaptation of Bernard and Clark's (1996) procedures, as outlined in the Data Analysis section of this plan.

The precision of Alaska hatchery and non-Alaska hatchery contribution estimates of Chinook and coho salmon can be found in Appendix A2 and A3). Accordingly, similar levels of precision are expected in the coming years.

The relative contribution estimates for each species by each CWT grouping will be multiplied by the corresponding preliminary harvest estimate to obtain the preliminary total contribution by CWT grouping.

Early Season Pacific Salmon Treaty Harvest in Districts 108 and 111 (Secondary Objective 1)

Estimates of the yearly Pacific Salmon Treaty Chinook salmon harvest will be obtained by subtracting out the components of the harvest that do not count against the treaty (e.g., Alaskan hatchery harvest) from the total Chinook salmon preliminary harvest estimate (from Secondary Objective 1). The early season estimate of Pacific Salmon Treaty harvest for CF Salmon Districts 108 (Petersburg-Wrangell) and 111 (Juneau), will be obtained in similar manner using the corresponding components of the current year's preliminary harvest estimates (from Objective 1a for late April to mid-July) combined with the past 5 years of recreational harvest timing data in these districts. The relative precision of early season Treaty harvest in Districts 108 and 111 is presented in Appendix A2.

Average Weight Estimates (Primary Objective 3) and Length Composition (Secondary Objective 6) of Pacific Halibut

Pacific halibut landed by boat parties within all surveyed fisheries will be sampled for length in order to estimate average net (headed and eviscerated) weights by user group and port (Primary Objective 3). Survey technicians will assign halibut harvested under GAF a separate halibut code for harvest recording and biological sampling; this is because GAF fish count towards the commercial halibut IFQ from which they are leased but are still part of the sport HPUE. Measured halibut retained under a GAF permit will not be included in the harvest calculations. All lengths will be measured to the nearest 5 millimeters (mm) using snout to fork (SNF) length. The length of each sampled halibut will be converted to an estimated weight using the regression factor reported by Clark (1992). The estimates for average weight or length will be obtained via the 4-stage weighted average estimation approach.

Periodically[8], the length composition of the halibut harvest, which is the proportion of halibut in each length grouping, by user group and port (Secondary Objective 6) will be estimated using a 4-stage weighted average estimation.

Mean net weights and standard deviations will be computed by port and user group. Because the ports of Petersburg and Wrangell are in the same SWHS area, the data for estimating the mean weight for these two ports were combined. Similarly, Gustavus and Elfin Cove are both in SWHS Area G, and their data were combined for estimation purposes as well. See Appendix A4 for expected relative precision.

Average Weight (Primary Objective 4) and Preliminary Biomass Estimates of Lingcod (Secondary Objective 9)

Lingcod landed by boat parties in Craig-Klawock, Sitka, Ketchikan, Gustavus, Elfin Cove, and Yakutat will be sampled for length in order to estimate the average round weight using the 4-stage sampling design. The average round weight estimates for each user group will then be multiplied by the current year's preliminary estimate of the harvest of lingcod (in numbers) for each user group to obtain the preliminary biomass estimate of the harvest of lingcod at each port. The yearly preliminary estimate of lingcod harvest at each port by user group will be calculated in the same manner as that described in the study design.

Expected precision can be found in Appendix A5. There are no precision goals for Juneau and Wrangell, ports with infrequent harvest of lingcod and a simple mean and variance may be reported for those ports.

Average Weight of All Rockfish species (Primary Objective 5) and Preliminary Estimates of Total Sport Removals in Biomass of Demersal Shelf Rockfish and Rockfish Species Composition (Secondary Objective 12a-b)

Rockfish landed by boat parties at all ports will be identified to species and sampled for length. At the Southeast Outside District sampled ports (Craig-Klawock, Sitka, Gustavus, Elfin Cove, and Yakutat combined) the measured lengths will be converted to a round weight by species and by user group using a length-weight relationship to estimate the average weight for each DSR species. See Table 7 for length-weight relationships and Appendix A6 – A14 for estimates of relative precision.

The preliminary estimate of total sport removals in biomass of Demersal Shelf Rockfish (DSR) will be derived from the weights estimated of all rockfish species in the DSR complex and will mirror the approach outlined for Pacific halibut.

Species composition of landed rockfish will be estimated by port and by user group. The species composition (i.e., percent composition) will be based upon data of the known rockfish species harvested (at least known to major rockfish group [i.e., demersal, pelagic, or slope]), and will exclude the unknown rockfish species harvest.

Age, Sex, and Length Composition of Black Rockfish (Primary Objective 6)

Black rockfish landed by boat parties in Sitka will be sampled for length, sex, and otolith (to determine age). Otoliths will be read by ADF&G SF staff in Homer over the winter. Due to the

[8] The IPHC has periodically requested the length composition estimates. They originally asked for length composition in the early 2000s in relation to what assumptions could be made about sport fishery selectivity. Most recently, they requested another summary in 2009; at that time, we summarized the length composition over the 2005–2009 time period (length composition as proportions in 10 cm length groups).

large number of black rockfish that can be harvested on each vessel, an assigned catch technician is directed to subsample every 4th fish (for ASL) from sampled vessels by design, while additional sampling occurs for length only by all other technicians.

Age data is a multinomial. For a 95% confidence interval the sample size necessary to estimate age proportions to be within 10 percentage points of the estimate is 127, to be within 5 percentage points is 510. (Thompson 2002) For binomial data such as sex, the sample size is even less; however, all black rockfish sampled for age will also be sampled for sex. Since it is expected in Sitka there will be more than 200 unguided and 1,000 guided black rockfish sampled for ASL data, then the precision criteria for Primary Objective 6, as it relates to age and sex should be met.

Expected precision can be found in Appendix A15.

Estimates of Genetic Composition of Chinook Salmon Harvest (Secondary Objective 2)

The genetic composition of the Chinook salmon harvested in the various fisheries (e.g., commercial troll, commercial driftnet, and sport) in Southeast Alaska is being analyzed by the ADF&G, CF Gene Conservation Laboratory (GCL) in Anchorage. A small section (approximately ¾-1 in) of the tip of a Chinook salmon's pelvic fin will be collected. It will be placed onto Whatman's paper and dried out using desiccant packs.

Genetic stock identification techniques will be used to generate regional estimates of the stock composition of the Chinook salmon sport fishery; genetic samples will be obtained by taking a representative sample over time from each port's fishery (Table 2). Chinook salmon harvested in local marine waters will be sampled from anglers bringing back fish to the docks and boat ramps at the sampled ports in Southeast Alaska. Small (<28 in TL) Chinook salmon, which are only allowed to be harvested in the Terminal Harvest Areas (THAs) for abbreviated time periods, will be sampled along with large (≥28 in TL) Chinook salmon harvested and landed at the fishery exit points. The target sample sizes for large Chinook salmon are based on the magnitude of each port's Chinook salmon harvest while addressing minimum sample size requirements provided by the GCL. Stock contribution estimates using genetics will be obtained for several regions—Northern Inside, Outside, Petersburg-Wrangell, and Ketchikan (Figure 3—and CF Salmon Districts 108 and 111 of SEAK (Table 3).

Table 2.–Sampling goals for Chinook salmon genetics by port for the Southeast Alaska sport fisheries during the spring and summer of 2019.

Port	Goal
Juneau	650
Haines	25
Skagway	20
Glacier Bay	80
Sitka	1,500
Yakutat	80
Elfin Cove	80
Craig	500
Petersburg	400
Wrangell	200
Ketchikan	700
Total	4,235

Table 3.–Strata for which stock composition estimates for Chinook salmon caught in Southeast Alaska sport fisheries will be generated each year.

Southeast AK region	Ports	Time strata
Northern Inside	Juneau, Haines, Skagway	All season
Outside	Glacier Bay, Sitka, Yakutat, Elfin Cove, Craig	All season
Outside	Glacier Bay, Sitka, Yakutat, Elfin Cove, Craig	Through biweek 13
Outside	Glacier Bay, Sitka, Yakutat, Elfin Cove, Craig	After biweek 13
Petersburg-Wrangell	Petersburg, Wrangell	All season
Ketchikan	Ketchikan	All season
DCF Salmon District 108	Petersburg, Wrangell	All season
DCF Salmon District 108	Petersburg, Wrangell	Through biweek 14
DCF Salmon District 108	Petersburg, Wrangell	After biweek 14
DCF Salmon District 111	Juneau	All season
DCF Salmon District 111	Juneau	Through biweek 14
DCF Salmon District 111	Juneau	After biweek 14

The actual number of samples used in the genetic analysis will depend on the proportion of harvest that each port contributed to the overall harvest of that region. Stock composition estimates for each area of the fishery will be weighted by harvest by port and biweek and will be treated in total for the entire season with the exception of fish caught in the Outside Region and for CF Salmon Districts 108 and 111. In the Outside Region, when possible, estimates will be further stratified by fish caught through biweek 13 versus those caught after biweek 13; in CF Salmon Districts 108 and 111, when possible, estimates will be further stratified by fish caught through biweek 14 versus those caught after biweek 14. Unbiased estimates of stock composition will be obtained only if the harvest is sampled proportionally during the entire season for all areas of the fishery. Sampling rates by biweekly period within each area and season combination will be compared for proportional sampling (i.e., the number of Chinook salmon by size class sampled for genetic structures will be compared to the index of harvest as obtained from the estimates associated with Objectives 1a and 2).

Results of this comparison will be reported to the CF Gene Conservation Laboratory; if necessary, either the genetics lab will stratify further from the samples obtained (to achieve proportional sampling within each substratum), or the genetics lab will use hierarchical analysis methods to weight the samples obtained (Sara Gilk-Baumer, Fisheries Geneticist II, ADF&G DCF Gene Conservation Laboratory, and Scott McPherson, Fishery Scientist I, ADF&G Division of Sport Fish, personal communication, December 9, 2010 meeting in Douglas).

Note that all Chinook salmon that are genetically sampled will also be sampled for scales and mid eye to tail fork (METF) length at all ports. The genetic sampling requires documenting the age of the individually sampled fish, and thus scales will be taken concurrently with genetic samples. Additionally, the genetics lab has requested sampling of otoliths from Chinook salmon sampled for genetics (and scales) at Sitka and Craig-Klawock; therefore, heads from genetically sampled fish at these ports will be collected for later otolith dissection.

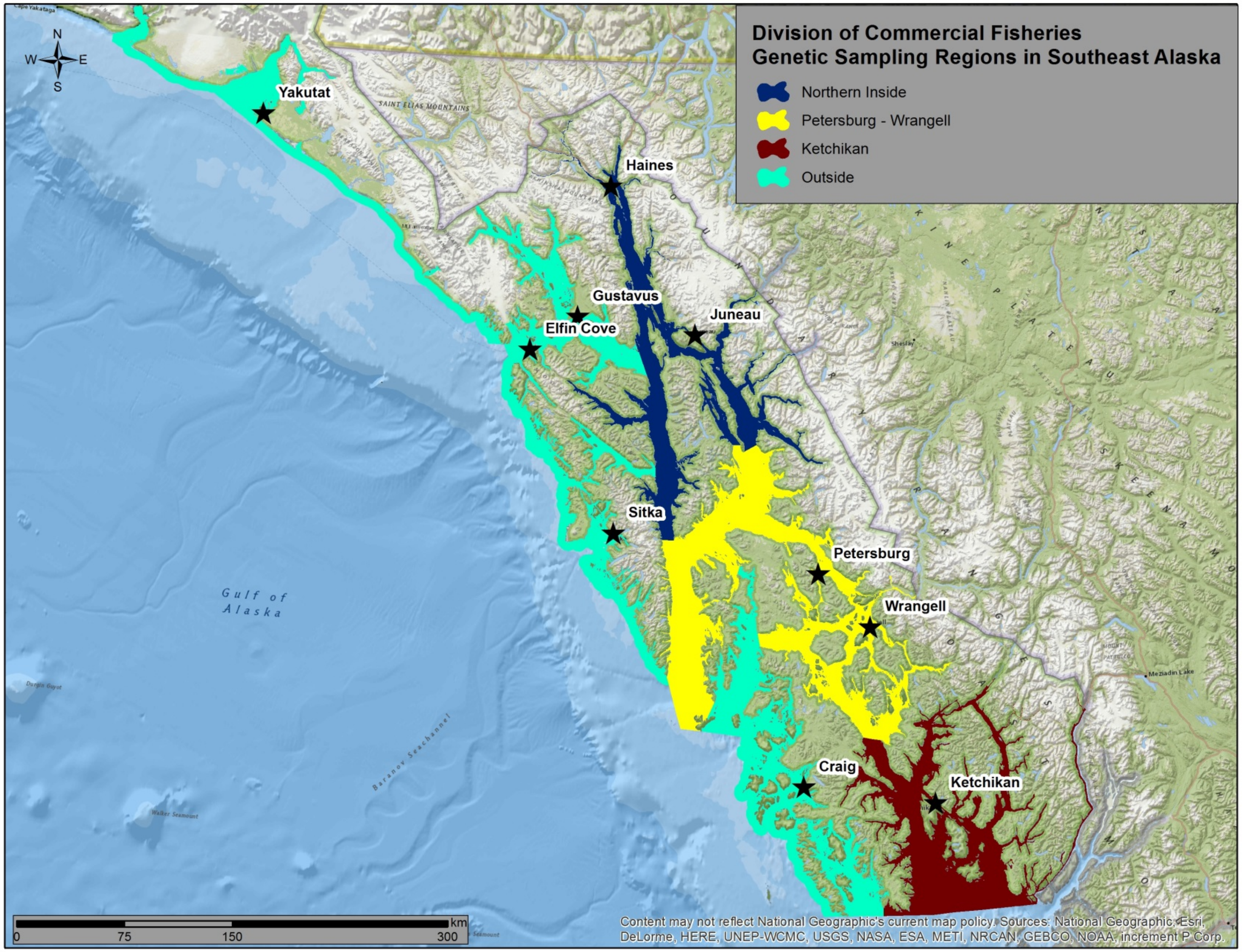

Figure 3.–Delineation of Division of Commercial Fisheries genetic sampling regions in Southeast Alaska.

Note that all Chinook salmon that are genetically sampled will also be sampled for scales and mid eye to tail fork (METF) length at all ports. The genetic sampling requires documenting the age of the individually sampled fish, and thus scales will be taken concurrently with genetic samples. Additionally, the genetics lab has requested sampling of otoliths from Chinook salmon sampled for genetics (and scales) at Sitka and Craig-Klawock; therefore, heads from genetically sampled fish at these ports will be collected for later otolith dissection.

Coded Wire Tag Sampling of Chinook and Coho (Secondary Objectives 3-4)

At all ports, harvested Chinook and coho salmon will be examined for adipose-fin clips, and every adipose-fin clipped Chinook and coho salmon will be sampled with a handheld tag detection wand (wand, hereafter) to identify 'no-tag' fish (those Chinook and coho salmon adipose-fin clipped but without a CWT). Only adipose-fin clipped fish returning a positive signal will have their head removed and sent to the MTA. The exception will be in Sitka and Craig, where heads of all Chinook salmon being selected for paired otolith/genetics/scale samples will be collected-regardless of adipose-fin status or wanding results. The total number of fish sampled and wanded as well as the return signal will be recorded at the docks.

At all ports, 10% of the adipose-intact Chinook salmon encountered will be sampled by wand to identify the presence of double index tags (DITs). The total number of fish sampled, wanded, and returning a positive signal will be recorded at the docks.

Weekly Harvest per Unit Effort of Chinook, Coho, Chum, and Pink Salmon, and Pacific Halibut (Secondary Objective 5)

All boat parties interviewed by technicians will be asked to report the number of targeted rod-hours directed at fishing for salmon and groundfish at each port. This information will be paired with the corresponding numbers of salmon or Pacific halibut harvested on a weekly basis to calculate a weekly HPUE for each species postseason and will be posted on the Division of Sport Fish website in the spring of the following year. These HPUE estimates are only intended as a guideline for use by the public for their information as to the level of effort expended to harvest 1 fish by species on a weekly basis. Measures of sport HPUE may be somewhat biased because of the way data are reported during an interview and should be used with caution to implement management measures in a fishery. Halibut collected using a GAF permit will be included in the HPUE calculations.

Proportion of Pacific Halibut Harvested by Unguided Anglers Prior to Mean IPHC Survey Date (Secondary Objective 8)

The mean IPHC survey date will be identified postseason and then used to post stratify the estimates of harvest before and after that date. The proportion of the harvest before the mean IPHC survey date will then be calculated from these.

Midseason Projected Preliminary Yearly Harvest of Lingcod and Yelloweye Rockfish (Secondary Objectives 10)

By the beginning of August, ADF&G managers need a projection of the relative magnitude of the yearly total harvest of lingcod and yelloweye rockfish in the ports of Sitka, Ketchikan, Craig-Klawock, Gustavus, Elfin Cove, and Yakutat. The projection of the relative magnitude will be made by comparing a projected total harvest for the current year to past-year harvest estimates. The projected total harvest for the year will be estimated by the same ratio expansion approach used to estimate the preliminary yearly harvest estimates for Chinook and coho salmon described previously (Primary Objectives 1a and 2a). In order to apply this approach midseason (by August), additional information on historical harvest timing from each port will be used to expand the harvest observed through July upwards to the level expected by the end of the year.

Collect Measurements of length from Sablefish (Secondary Objective 11)

Lengths from sampled sablefish will be recorded from snout to fork (SNF) to the nearest 5 mm at all surveyed ports. Sablefish length information will be delivered in raw form to the statewide groundfish coordinator for the Division of Sport Fish.

Estimates of the Proportion of Unguided Boat Trips Utilizing Deepwater Release Devices in the Release of Rockfish (Secondary Objective 13)

During the 2019 sampling season the Marine Harvest Studies Project will collect data on current levels of utilization of rockfish release devices by unguided anglers. Unguided anglers who released rockfish during their trip will be asked if they employed the use of a rockfish release device at least 1 time during the trip; their response will be recorded as a yes-no answer. The ratio of the number of boat trips in which a release device was utilized to the total number of boat trips in which rockfish were released will be used to obtain an estimate of the percentage of unguided boat trips on which release devices were used. In addition, all anglers will be solicited with information pertaining to the merits of utilizing rockfish release devices and their proper use in order to increase public awareness and acceptance of the devices.

Release Estimates for Chinook Salmon, Rockfish, Pacific Halibut, and Lingcod (Secondary Objective 14 and 7)

During all interview samples, boat parties will be asked to report the numbers of released Chinook salmon (both <28 in and ≥28 in, total length [TL]), rockfish (yelloweye, other DSR, slope, and pelagic rockfish), halibut, and lingcod by species (or species grouping for DSR, slope, and pelagic rockfish). These reported values will be combined with the observed-reported numbers of fish harvested to estimate the total catch by species, which are then used to calculate the proportion of the catch that was released. Halibut release data will be collected for size classes below, above, and within the reverse slot size limits. These data will be provided to the Statewide Pacific Halibut Estimation Program to allow the project to estimate the average weight of released halibut and assess the efficacy of the reverse slot limit as a management tool for sport caught halibut. The numbers of fish caught that were released will be used in the 4-stage weighted average to estimate these proportions (see the Data Analysis section for details).

DATA COLLECTION

The project utilizes two different types of sampling technicians: creel technicians and catch technicians. Creel technicians record harvest, effort, and biological samples where catch technicians concentrate on CWT sampling of Chinook and coho salmon and collection of biological samples and harvest related to those samples.

For creel technicians, data will be collected from each boat party interviewed during a scheduled time at a specific location that is selected randomly. All ports will have survey technicians that complete interviews during each scheduled sampling period. Collected information will include number of rods fished, number of anglers fishing (by residency), hours fished, trip type (guided or unguided), number of days in trip, location fished, target (e.g., salmon or groundfish), number of fish kept and released by species, release size category for halibut, and use of a deep-water release device for rockfish. They will also record the logbook number of the charter operator, and if the numbers of fish harvested by species have been physically verified. Catch technicians will record the trip type and number of fish harvested that were sampled. Both technicians will record the number of boats returning to the harbor as follows: 1) sport fishing and interviewed, 2) sport fishing but not interviewed, 3) contacted but not sport fishing, and 4) not contacted but could be sport fishing.

All technicians will also sample harvested fish as scheduled. Harvests of Chinook and coho salmon will be checked for coded-wire tags by looking for adipose finclips or utilizing a T-wand to detect a tag in the head of Chinook salmon with their adipose fin intact. Heads from these fish will be collected and identified with a uniquely numbered cinch strap (assigned by the Tag Lab) and the METF length recorded to the nearest 5 mm.

Chinook salmon selected for genetic sampling will be sampled for scales and will have a portion of their pelvic fin, excised. Five scales will be taken near the preferred area on each Chinook salmon at a point on a diagonal line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, 2 rows above the lateral line (Welander 1940). If the scales in the preferred location cannot be obtained, another set of scales will be taken from as close to the preferred scale area as possible. However, scales will only be taken from the area bounded dorsally by the fourth row of scales above the lateral line, ventrally by the lateral line, and between lines drawn vertically from the posterior insertion of the dorsal fin and the anterior insertion of the anal fin. If no scales are available in the preferred area on the left side of the fish, scales will be collected from the preferred area on the right side of the fish. Scales will then be mounted on gum cards, and impressions will be made in cellulose acetates (Clutter and Whitesel 1956). The scales will then be aged using ADF&G procedures (S. McPherson, Chinook Salmon Advisor, ADF&G, Division of Sport Fish, Douglas, personnel communication). Lengths to the nearest 5 mm (METF) of these Chinook salmon will also be recorded. In addition, Chinook salmon heads will be collected at the ports of Sitka and Craig-Klawock for the purpose of otolith analysis. Similar to CWT-sampled Chinook salmon, heads collected for otolith sampling will likewise be identified by a uniquely numbered coordination tag (also assigned by the Tag Lab).

Lengths from sampled halibut, rockfish, lingcod, and sablefish will be recorded from snout to fork (SNF) to the nearest 5 mm. In the port of Sitka, black rockfish will be sampled for SNF length, sex and otolith (for aging). The otoliths are to be cleaned and placed in sequentially numbered coin envelopes.

All onsite interview and biological data will be recorded electronically on handheld computers. All data recording procedures are outlined in detail in the current year’s Southeast Alaska Marine Harvest Studies Creel Technician Manual (unpublished), which is provided to the field technicians annually.

Site-Specific Procedures

For all ports, the overall sampling design is described in the **Study Design** section of this operational plan. The general design features for sample selection and the data analysis procedures, as described below, are the same for all locations unless otherwise noted.

Prior to the 2011 sampling season, sample selection at the various stages in the multistage study design at Ketchikan, Juneau, and Sitka generally involved random selection from all available days, time periods within the "angling day," and from the majority of access locations from which sport boat parties exited the sport fishery, and calculations were performed as if the data had been gathered as a simple random sample. Sampling design changes beginning in 2011 include using boat party counts to weight the information collected during interviews in a multistage manner. In Ketchikan, Juneau, and Sitka, access locations with little harvest were dropped unless they included underrepresented species or angler types. In some smaller ports, where there are fewer vessels per access location, the strategy was changed to assign the port as the access location, with each access location within it as sub-harbors, or sub-access location. The creel technicians would then roam between these sub-locations based on use. This strategy will be employed during the 2019 season.

The ports of Juneau, Sitka, Petersburg, and Ketchikan hold salmon derbies that are contained in a period of 3-7 days depending on port. The total number of derby-entered Chinook and/or coho salmon will be known after sampling; therefore, instead of using the estimate number of entered fish, the total count will be used. The derby-entered Chinook and/or coho salmon will be added to the estimates of non-derby entered fish for a total estimated harvest. This number is then expanded to the SWHS during the process of calculating the preliminary values for these fisheries.

At all locations, sampling will be grouped into biweekly periods. Biweeks for 2019 are as follows: 29 April–12 May, 13-26 May, 27 May–09 June, 10-23 June, 24 June–07 July, 08-21 July, 22 July–04 August, 05–18 August, 19 August–01 September, and 02–15 September (the start-end dates for each site differ as noted in Table 1). Holidays include the dates of 27 May, 4 July, and 2 September. Unless specifically stated below, the sampling technicians intercept anglers for 6.5 hours each scheduled day. All weekends and holidays will be worked, and technicians will get 2 consecutive standard days off (SDO) each week. The schedule was generated as follows: first, 2 days off were set, then locations to sample from the access locations were selected at random without replacement (WOR). The scheduling of days and periods to sample within the entire survey were structurally different for derby versus nonderby periods.

Ketchikan, Sitka, and Craig-Klawock also have 1 or more catch technicians to conduct additional CWT sampling of Chinook and coho salmon to increase the proportion of harvested Chinook and coho salmon inspected for adipose finclips and to increase CWT recoveries of wild stock Chinook and coho salmon, all to determine the Alaskan hatchery contributions. The catch technicians will also conduct biological sampling of Chinook salmon and groundfish species. These catch technicians can roam between access locations and sample access locations not covered in a day by the creel technicians.

The following sections outline details regarding specific access locations, days of the week, periods of the day, and allocation of technician shifts that are unique to each major port. Additionally, site-specific details regarding data collection and recording procedures are given in the Southeast Alaska Marine Harvest Studies Creel Technician Manual (unpublished).

Ketchikan Marine Boat Fishery Survey

The Ketchikan marine boat sport fishery will be surveyed from 29 April through 15 September 2019, with the Ketchikan Salmon Derby occurring from 17-18 August, 24-25 August, and 31 August-2 September. Five access locations will be sampled by a total of 2 to 5 staff, depending upon the period of the survey.

Within the 3 derby biweekly periods (biweeks 16-18), 3-5 technicians will conduct creel and catch sampling (Table 4). Two of the 4 derby weigh-in stations (Mountain Point [south], Bar Harbor I [in town], and Clover Pass and Knudson Cove [north]) will be covered to sample for CWT. The 7-day derby normally takes place starting the Memorial Day weekend and is a Chinook derby; however, starting in 2018 the derby was moved to August and will be a coho derby. The derby officials maintain an official count of the total number of fish entered. To ensure the samples are representative of the stock composition, a south-of-town or in-town harbor and a north-of-town harbor will be scheduled.

Table 4.–Summary of study design features for the 2019 onsite catch sampling survey of the Ketchikan marine boat sport fishery in Southeast Alaska.

Biweekly periods	Dates	Number of days sampled	Number of access locations	Number of access locations sampled per day	Derby weigh-in stations sampled (4 total)
9	29 Apr–12 May	10	5	2	0
10	13 May–26 May	10	5	3	0
11	27 May–09 Jun	10	5	3	0
12	10–23 Jun	10	5	3	0
13	24 Jun–07 Jul	10	5	3	0
14	08-21 Jul	10	5	3	0
15	22 Jul-04 Aug	10	5	3	0
16	05 Aug–18 Aug	10	5	3	0
Derby Entered	17-18 Aug	2	4	2	4
17	19 Aug-01 Sep	10	5	3	0
Derby Entered	24-25, 31 Aug–1 Sep	4	4	2	4
18	02 Sep–15 Sep	10	5	3	0
Derby Entered	2 Sep	1	4	2	4

Sitka Marine Boat Fishery Survey

The Sitka marine boat sport fishery will be surveyed from 29 April to 15 September 2019, with the Sitka Chinook Salmon Derby occurring from 25 - 27 May and 1-2 June. Eight access locations in the Sitka marine boat fishery will be sampled by 2 to 6 staff, depending on the period of the survey.

A similar procedure was used for scheduling sampling during the derby biweekly period. The numbers of sampling units scheduled for each year are summarized in Table 5. A catch technician will be stationed at the derby weigh-in station on Crescent Harbor. Additional derby entries will be sampled when the floating weigh-in station delivers to the processing plant. All fish will be counted and sampled for CWT with a subsample taken for GSI and otolith sampling.

Table 5.–Summary of study design features for the 2019 onsite catch sampling survey of the Sitka marine boat sport fishery in Southeast Alaska.

Biweekly periods	Dates	Number of days sampled	Number of access locations	Number of access locations sampled per day	Derby weigh-in stations sampled[9]
9	29 Apr–12 May	10	8	2	0
10	13 May–26 May	10	8	3	0
Derby Entered	25–26 May	2	2	2	2
11	27 May–09 Jun	10	8	3	0
Derby Entered	27 May, 01–02 Jun	3	2	2	2
12	10–23 Jun	10	8	3	0
13	24 Jun–07 Jul	10	8	3	0
14	08-21 Jul	10	8	3	0
15	22 Jul-04 Aug	10	8	3	0
16	05–18 Aug	10	8	3	0
17	19 Aug–01 Sep	10	8	3	0
18	02–15 Sep	10	8	2	0

Juneau Marine Boat Fishery Surveys[10]

The Juneau marine boat sport fishery will be surveyed from 06 May through 15 September 2019, with the Golden North Salmon Derby occurring 16-18 August 2019. Six access locations will be sampled by 3 to 6 staff with overlapping morning and evening shifts.

Similarly, within the derby biweekly period, 3–5 creel technicians will conduct creel sampling with additional personnel stationed at each of the derby weigh-in stations (Auke Bay Government, Douglas Harbor, Amalga Harbor, and the floating processor). In Juneau, the derby stations do not keep a count of the total number of entered fish; therefore, all derby-entered Chinook and coho salmon will be counted and sampled for CWT at the weigh-in stations with a subsample of Chinook salmon taken for GSI. The numbers of sampling units by stratum scheduled for 2019 are outlined in Table 6.

[9] In Sitka, derby-entered fish can be entered on a floating tender, so this is considered an access location during the derby. A sampler is unable to be stationed on the tender so sampling is done when the tender offloads at the processing plant.

[10] Due to Chinook fishery closures, the roadside Picnic Cove fishery on Douglas Island will not be sampled in 2019.

Table 6.–Summary of study design features for the 2019 onsite catch sampling survey of the Juneau marine boat sport fishery in Southeast Alaska.

Biweekly periods	Dates	Number of days sampled	Number of access locations	Number of access locations sampled per day	Derby weigh-in stations sampled[11]
9	29 Apr–12 May	5	6	3–4	0
10	13–26 May	10	6	3–4	0
11	27 May– 09 Jun	10	6	3–4	0
12	10–23 Jun	10	6	3–4	0
13	24 Jun–07 Jul	10	6	3–4	0
14	08-21 Jul	10	6	3–4	0
15	22 Jul–04 Aug	10	6	3–4	0
16	05–18 Aug	10	6	3–4	0
Derby Entered	16–18 Aug	3	4	4	4
17	19 Aug–01 Sep	10	6	3–4	0
18	02–15 Sep	10	6	5	0

Craig-Klawock Marine Boat Fishery Survey

The Craig-Klawock marine sport fishery will be sampled from 29 April to 01 September 2019. There are 6 access locations in Craig, and 5 access locations in the Klawock area sampled by 2–4 technicians. Creel technicians will be scheduled at either Craig or Klawock and will roam between the access locations based on usage.

Craig and Klawock will each be sampled every day of the biweek, with 1 technician to work in the office on Monday. This design should provide a consistent proportion of sampling effort throughout the season and maximize the number of Chinook and coho salmon sampled.

Some lodges, at least 2 in Craig, will only allow biological sampling of their fish. Therefore, only the catch technicians will sample these docks.

Petersburg Marine Boat Fishery Survey

The Petersburg marine boat fishery will be sampled from 29 April to 01 September 2019. One to 2 technicians will sample the harvest of boat anglers returning to 3 access locations. The 4-day Petersburg Salmon Derby normally held over the Memorial Day weekend is cancelled for 2019.

Wrangell Marine Boat Fishery Survey

The Wrangell marine boat fishery will be sampled from 29 April to 01 September 2019. One to 2 technicians will sample the harvest of boat anglers returning to 3 access locations in the Wrangell area. Wrangell has 2 shifts per sampling day with each access location randomly chosen with replacement. The time periods of the shifts vary between weekdays and weekend-holidays.

[11] In Juneau, fish can be entered on a tender, so this is considered an access location during the derby. A sampler is able to be stationed on the tender so sampling is also conducted there.

Gustavus Marine Boat Fishery Survey

The Gustavus marine boat fishery will be sampled from 06 May to 01 September 2019. One technician will sample the harvest of boat anglers returning to 1 access location in the Gustavus area. In the spring, the Bartlett Cove access location may also be surveyed.

Elfin Cove Marine Boat Fishery Survey

The Elfin Cove marine boat fishery will be sampled from 06 May to 01 September 2019. One technician will sample the harvest of boat anglers returning to 2 access locations (an inner and outer harbor separated by a narrow channel at Elfin Cove), each with private-lodge docks and one public dock. The technician will be assigned to either the inner or outer harbor each day and will roam between access locations within the assigned harbor.

Yakutat Marine Boat Fishery Survey

The Yakutat marine boat fishery will be sampled from 29 April to 01 September 2019. One technician will sample the harvest of boat anglers returning to 3 access locations.

DATA REDUCTION

Data will be electronically captured on the Marine Harvest Studies application and transmitted at least weekly to a cloud server by all technicians in all ports. From there the relational database located on a Juneau ADF&G server will be triggered to download the data from the cloud server. The data can be accessed and edited via SQL management studio[12], a web viewer, or accessed and read into a statistical analysis system dataset using SAS for Windows. If the application or handheld fail, technicians will revert to recording the data on mark-sense forms, which will be checked and run through an optical scanner with the resulting comma delimited text file imported into SAS for Windows. Steps outlined below are specific to electronic capture but are similar for paper recording.

All technicians will record boat information, effort, harvest, biological data, and photos into the application on their handhelds, currently an Apple iPad Air or iPad 9.7, 6th generation protected with a Lifeproof fré case and floating lifejacket. The application has built in validations for common warnings and errors to assist the technicians while recording the data (see the Handheld training manual for the list). Technicians are required to review their data, correcting all errors and warnings or making comments as to why the data is incomplete or in error. They will also verify all CWT and otolith strap numbers, and Whatman and scale card numbers to ensure all data was keyed in correctly. Once checked, data and photos are transmitted to the cloud server. Technicians should transmit daily, or at a minimum weekly, with all data transmitted by Sunday night. In addition, all biological samples must also be turned into the area office each Sunday night.

On Monday morning, each designated management office will verify all shifts have been transmitted and download the list of biological data expected in their port. They will compare the list to the physical samples, correct as necessary, and t-wand all CWT heads to see if they detect a tag in the office. The database will be reviewed and corrected at least weekly for any records not passing validation, and any records with CWT data will be verified and marked as clean to flag

[12] Product names used in this publication are included for completeness but do not constitute product endorsement.

these records for the tag lab to download the coded wire tag data report. If any errors are found in a CWT record after this point, the tag lab will need to be notified directly about the change.

The biological data will then be shipped to the Douglas office and salmon CWT and otolith heads shipped to the CWT lab in Juneau where any tags present will be removed and decoded. All shipments of cinch-strapped heads will include the date and number of heads in each shipment. The tag lab will access all data associated with these salmon directly from the relational database via a report table. The tag recovery information from each head will then be entered into the Tag Lab database.

Data will then be run through various SAS error checking programs with feedback passed on to technicians at each stage. After final checking of the SAS datasets, the data will be analyzed according to the procedures outlined below. In conjunction with Tag Lab personnel, the number of fish sampled for adipose finclips and estimated harvest (for the onsite creel survey locations) will also be entered into a related database so that hatchery contribution estimates can be generated directly. Once data are finalized, the data files will be archived on the Douglas server, with all raw data available in the relational database.

Chinook salmon scales will be pressed onto acetates and then read by Division personnel. Ages will be recorded on printouts, keypunched into the Excel spreadsheet, and then imported into the database. Black rockfish otoliths will be read by Division personnel. Ages will be recoded into an Excel spreadsheet, and then imported into the database. Chinook otolith samples will be dissected and processed by the MTA Lab in Juneau, and Chinook genetic samples will be shipped to the Genetics lab in Anchorage. Resulting data from these otolith and genetic samples are not returned to this program, but results remain on the associated Commercial Fisheries database.

DATA ANALYSIS

The data analysis procedures generally involve a 2-step estimation approach. The first step involves estimation of parameters that are intrinsic to the information gathered during the fielding of this project, such as data gathered regarding the characteristics of intercepted boat parties and their harvest during creel or catch sampling, or data derived after laboratory follow-up activities (e.g., CWT analyses). The second step involves expanding these intrinsically-based estimates to the corresponding preliminary yearly projections of the parameter estimates calculated following publication of the final SWHS estimates (extrinsic estimates) of harvest for the corresponding species or species group. Application of the 2-step estimation approach takes place for most of the objectives following the completion of all data collection by this project for the season, although for some objectives, the process occurs at "midseason" milestone dates (e.g., Secondary Objective 10: beginning of August projections related to lingcod and Yelloweye rockfish harvest).

In the following subsections, the general 2-step estimation approach is outlined for both the mid-season and end-of-season projections of the preliminary parameter estimates. These subsections are then followed by specific details regarding application of the estimation approach for each of the objectives.

General Estimation Approach

Intrinsic Parameter Estimates

The general study design for this project involves estimation of proportions or averages of the specific elements of harvest for each fishery from the on-site survey, which are then applied to the corresponding final estimates from the SWHS. The on-site sample survey design is a stratified 4-stage cluster sample survey with the following:

1) days to sample across each time period represent the first-stage sampling units;
2) access locations, the harbors and boat launches sampled within a selected day, represent the second-stage sampling units;
3) the boat parties exiting the fishery during each day at each access location represent the third-stage sampling units; and
4) each fish (by species) represents the fourth-stage or "terminal" sampling unit.

Variance for the fourth stage will most often be zero because technicians are required to take all measurements whenever they take at least 1 measurement from a fish of each species. However, the variance will not be zero if a measurement is lost or a species is subsampled by design (e.g., black rockfish otolith sampling in Sitka). For the point estimate, the fourth stage is necessary regardless of whether variance is zero or not.

For ports where sampling occurs on every day of the biweek—such as Juneau and Craig-Klawock—this 4-stage equation naturally collapses to a 3-stage equation. The expansion for subsampling days then becomes 1 with a variance of zero because all days are sampled. Where estimates reflect abundance, such as the total number of fish harvested, the biweekly estimates and variances will be summed to produce seasonwide estimates and variances. Where estimates are for proportions or averages, only a seasonwide estimate (i.e., with stage 1 being all days in the season), will be reported. The strata used to generate estimates are composed of a combination of general port location (e.g., Ketchikan), time period (e.g., biweek or season), and components of the fishery (guided and unguided). Information on the number of exiting boat parties will be recorded at each sampled access location during each sampled day for all samples, and when combined with the numbers of fish by species observed on each sampled boat will provide weighting factors for each sampling stage to address the likelihood that the sampling will not be exactly proportional to the harvest of all species at all times.

At all ports, the creel technicians gather information from each intercepted boat party on the following parameters: effort, harvest, and catch, logbook information, and biological sampling of the catch. During these scheduled interviews, the creel technicians additionally gather and record information on the number of exiting boat parties used in the weighting estimation process described later. As noted previously, 1 or more technicians at the ports of Ketchikan, Sitka, and Craig-Klawock conduct shifts where only catch sampling occurs. These catch technicians will also collect and record a corresponding count of the number of exiting boat parties. However, to maximize the number of fish (of one or more species or group of species) sampled for CWT and biological characteristics, catch technicians can roam across access locations and focus on busy portions of an access location. Accordingly, the boat counts for these catch technicians will only be a gross measure of the general fishing activity for weighting purposes.

Standard estimation equations will be used to calculate estimates of the intrinsic averages or proportions associated with the objectives for this project for a stratified 4-stage sample survey with days, exit locations, boat parties, and harvested fish by species representing the sampling stages. Additionally, the standard estimation equations for the corresponding variance estimates will be used as approximations of the sampling variance and standard errors (SEs). The equations were adapted from equations in Sukhatme et al. (1984: section 8.10 pages 346–351) for estimating averages for a 3-stage sample survey. The coded-variable approach for obtaining estimates associated with proportions is also per Sukatme et al. (1984: section 2.10, pages 42–45). Because the sampling unit selection procedures for this survey are not done as a random probability-based sample survey in the standard sense, the corresponding variance and SE estimates are considered approximations[13] as noted above.

The parameters of interest associated with the objectives for this project mostly represent averages or proportions of the corresponding harvest (or in some cases numbers of fish released) by species. In some instances, the parameter of interest is the magnitude of the harvest or the numbers of fish released by species or species group itself (e.g., Primary Objective 1a: total sport harvest of Chinook salmon). The weighting factors associated with the weighting estimation approach provide estimates of the magnitude of the harvest itself. The averages associated with the "*y*" terms in the equations below represent the former parameter estimates (averages or proportions); whereas the "*N*" terms represent the latter parameter estimates (total harvest). Because sampling at all ports is directed at only a portion of the locations from which anglers access the various fisheries, and sampling shifts are by design directed at the busier portions of the day and days of the week, then the estimated harvest is not an unbiased estimate of the harvest by user group at each port for the season in total. Additionally, because the counts of boat parties that are not sampled for creel or catch samples are only approximately accurate, then the expansion associated with the number of boat parties within a sampled shift (access location within a day for creel samples) only provides an approximate estimate of the harvest during the shift. These estimates of harvest (*N*) are used with corresponding final SWHS harvest estimates in expanding up to the preliminary yearly values for the associated parameters via the ratio estimation approach outlined in this operational plan. Accordingly, these intrinsic estimates of harvest are referenced herein as harvest indices.

Calculation of estimates of the CWT contributions for Chinook and coho salmon (Primary Objectives 1b, 2b, and Secondary Objective 1) will not involve direct use of the 4-stage cluster estimating equations. The specific equations for the CWT estimation approach that are adapted from Bernard and Clark (1996) are outlined after the 4-stage cluster estimating equations described below.

Four-stage Estimating Equations

The first step in the 4-stage estimating equation calculation involves estimating an average of the measurement for parameters of interest across all fish by species or species group within a sampled boat party:

$$\bar{y}_{hijk} = \frac{\sum_{o=1}^{n_{mhijk}} y_{hijko}}{n_{mhijk}} \tag{1}$$

[13] The degree of approximation is expected to be slight in that the sample selection process in some instances closely approximates a random sampling process or represents a census or a near census at some of the sampling stages in the 4-stage sampling process. Also, the use of the 4-stage variance estimating equations is expected to represent a better description of the sampling error than the 'naïve' estimators used in past years, wherein the multistage design was ignored and the data on such parameters as species composition for rockfish were treated as if it was obtained by a simple random sampling design with replacement, even though the data were obtained by a multistage sample survey without replacement.

where: n_{mhijk} is the number of fish sampled (where *m* stands for measured) for the average or proportion from the total number harvested by sampled boat party *k*, at sampled access location *j* (i.e., the sampled harbor or boat launch) during sampled day *i* within stratum *h*[14]; and y_{hijko} equals the measurement (or converted measurement) for parameters of interest representing averages (e.g., weight of each fish) for the o^{th} fish sampled from each sampled boat party. In the case of parameters that represent proportions (for example, species composition), then the y_{hijko} equals the coding for proportional estimates as follows:

$$y_{chijko} = \begin{cases} 1, \text{ if the fish belongs to the category } c \text{ associated with each proportion;} \\ 0, \text{ otherwise.} \end{cases} \tag{2}$$

Note that there would be *C* separate values of these coded values associated with each category in the proportion. For example, if the proportions of interest had 4 categories ($C = 4$), there would be separate calculations for each of the 4 categories (denoted by the subscript *c*), and each would then be substituted into Equation 1.

The estimate (from Equation 1) will then be weighted by the relative 'size' of each boat party compared to other boat parties sampled (for the average or proportion) within the same access location sampled within the sampled day, with the weight calculated as follows (wherein 'size' relates to the number of fish by species or species group):

$$w_{4hijk} = \frac{N_{mhijk}}{\overline{N}_{mhij}} \tag{3}$$

where N_{mhijk} is the number of fish by species or species group selected for measurement from each sampled boat party's harvest (note that by design for all species except for black rockfish with otoliths collected, $N_{mhijk} = n_{mhijk}$ the number of fish sampled for the measurement or characteristic of interest for an individual sampled boat, i.e., only complete bags sampled); and $\overline{N}_{mhij}$ is the average across boat parties sampled at each sampled access location within a sampled day, calculated as:

$$\overline{N}_{mhij} = \frac{\sum_{k=1}^{b_{mhij}} N_{mhijk}}{b_{mhij}} \tag{4}$$

where b_{mhij} equals the number of boat parties with species or species group selected for measurement at each access location within each sampled day for the guided and unguided components of the fishery at each port for the average or proportional parameter estimates.

[14] Although strata are defined as the combination of major port, biweek and user group: guided versus unguided, the referencing of strata (or stratum) in these equations is restricted to the distinction between the user groups (guided/unguided) for each port.

For the parameters involving estimates of the number of fish harvested (or the number of fish caught, or number released)[15], a parallel computation to those noted above in equation 4 is calculated for all fish harvested by species or species group over all the boats interviewed at each sampled access location within each sampled day (i.e., including both fish sampled and measured for the characteristic of interest, and fish that were on boats that were interviewed, but not sampled), as follows:

$$\overline{N}_{hij} = \frac{\sum_{k=1}^{b'_{hij}} N_{hijk}}{b'_{hij}} \tag{5}$$

where N_{hijk} is the number of fish harvested by species (includes measured and unmeasured fish[16]) on an interviewed boat; b'_{hij} is the number of boats interviewed where anglers provided trip information within each sampled access location within each sampled day (includes boats that were interviewed but for which no fish were sampled for the measurement of interest). The b'_{hij} term is a subset of the b_{hij} term, which includes any boat that was known to be sport fishing regardless as to whether they provided information.

The $\overline{N}_{hij}$ term is then used to expand up to the index of the number of fish harvested at the sampled access location within the sampled day within stratum *h* (guided versus unguided), as follows:

$$\hat{N}_{hij} = \frac{\hat{B}_{ij}\hat{b}_{hij}}{b_{ij}}\overline{N}_{hij} = \hat{B}_{hij}\overline{N}_{hij} \tag{6}$$

where b_{ij} is the total number of boat parties that were determined to be sport fishing regardless of strata (i.e., guided plus unguided boats); $\hat{b}_{hij}$ is the estimated number within stratum h (guided or unguided, see equation 8) and $\hat{B}_{ij}$ is the estimated number of sport fishing boat parties expanded for missed boats which are those that are seen exiting but are not interviewed.(note that counts of boat parties are not distinguished by user group, so no *h* subscript denoting guided versus unguided), calculated for technicians as:

$$\hat{B}_{ij} = A_{ij}\frac{b_{ij}}{a_{ij}} \tag{7}$$

where b_{ij} is the total number of boat parties known to be sport fishing (includes noncompliant and missed boats known to be sport fishing where guide status may not be known), a_{ij} is the total

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[15] A few of the objectives or tasks require the estimation of the number of fish released or the number caught (harvested plus released) by species or species group; in the exposition of the equations in this section of the plan the equations used for estimating the numbers of fish harvested can be used with the number of fish reported released to obtain the estimate of fish released. The numbers released will only be referenced hereafter when necessary.

[16] For the catch technician data, the numbers of fish harvested for species or species groups for a boat party are only recorded for the fish that are measured. Accordingly, the catch technician data are essentially treated as self-represented in the weighting process and $N_{hijk} = N_{mhijk}$ in equation 5 and b'_hij = b_mhij.

number of boat parties that were determined to be sport fishing or were determined to not be sport fishing; and A_{ij} is the number of all boats counted exiting the sampled access location during the sampled day (includes sport fishing and nonsport fishing boats, as well as "missed" boats)[17]. The calculation of these indices of harvest (the $\hat{N}_{hij}$ terms) for use in later expansion to project the final SWHS corresponding estimates of harvest will be limited to using the data from creel technician data only (i.e., not including the catch technician data), due to the limitations of catch technicians only recording harvest of sampled fish.

The values of $\hat{b}_{hij}$ for each stratum (guided versus unguided) are estimated by expansion of the proportion of boats in each stratum compared to all sport fishing boats (which may include sport fishing boats that could not be assigned to a stratum), as follows:

$$\hat{b}_{Cij} = b_{ij}\frac{b_{Cij}}{(b_{Cij} + b_{Pij})} \quad or \quad \hat{b}_{Gij} = b_{ij}\frac{b_{Pij}}{(b_{Cij} + b_{Pij})} \tag{8}$$

where the C and P subscripts correspond to the guided (chartered) and unguided (private) strata.

The next step for estimating the averages or proportional parameters involve applying the weight derived in Equation 3 to each of the averages from Equation 1 as follows:

$$\bar{y}_{whijk} = w_{4hijk}\bar{y}_{hijk} \tag{9}$$

which is then used to estimate the average across all boat parties by user group within a sampled access location within each sampled day:

$$\bar{y}_{hij} = \frac{\sum_{k=1}^{b_{mhij}} \bar{y}_{whijk}}{b_{mhij}} \tag{10}$$

The next step in estimating the index of the harvest of fish involves first averaging the number harvested across access locations sampled within each sampled day calculated as:

$$\bar{\hat{N}}_{hi} = \frac{\sum_{j=1}^{q_i} \hat{N}_{hij}}{q_i} \tag{11}$$

where $\hat{N}_{hij}$ is the index of the number of fish harvested by each species or species group for each sampled access location as calculated above in Equation 6; and q_i is the number of access locations sampled within each sampled day (at this stage of the sampling there is no distinction between the

[17] Note that some boat parties at some access locations are known to never sport fish (see the Data Collection section and the SEAK Marine Harvest Studies Technician Manual [unpublished] for details), these boat parties are not included in either the A_i or the a_i counts.

guided and unguided components, and hence the dropping of the stratum subscript *h* in regards to the statistic q_i).

The $\overline{\hat{N}}_{hi}$ term is then used to expand up to the index of the number of fish harvested during the sampled day by user group (guided versus unguided), as follows:

$$\hat{N}_{hi} = Q_i \overline{\hat{N}}_{hi} \tag{12}$$

where Q_i is the number of access locations that could have been sampled within each day.

The next step in estimating the average or proportional parameters involves weighting across third-stage sampling units (locations). Ideally, the third-stage sample weights to be used for estimating average or proportional parameters would have involved the estimated harvest index over all sport fishing boat parties sampled within a day across all access locations, both those sampled for the characteristic of interest and those not sampled (but sport fishing). However, because catch technicians do not record the full harvest (only fish that are sampled) and catch technician information could exists without a matched creel sample with the corresponding estimate of the number of fish harvested within a day[18], then a direct use of the estimated harvest index cannot be used. Accordingly, substitute calculations, including harvest data from creel and catch technicians (denoted by the use of tildes (~)) will be used to approximate the third and second-stage weights;

first, an approximate number of fish harvested by each stratum within each sampled day at each location is calculated[19]:

$$\tilde{N}_{hij} = \frac{\hat{B}_{ij}\hat{b}_{hij}}{b_{ij}} \overline{N}_{hij} \tag{13}$$

These approximate harvest indices are then averaged over all access locations sampled for the average or proportion of interest within a day, as follows[20]:

$$\overline{\tilde{N}}_{hi} = \frac{\sum_{j=1}^{q_i} \tilde{N}_{hij}}{q_i} \tag{14}$$

These terms are then used to calculate the approximate third-stage sample weights as follows:

$$\tilde{w}_{3hij} = \frac{\tilde{N}_{hij}}{\overline{\tilde{N}}_{hi}} \tag{15}$$

This approximate weight is then used for estimating the averages or proportional parameters by applying the weight derived in Equation 15 to each of the averages from Equation 10 as follows:

$$\bar{y}_{whij} = \tilde{w}_{3hij} \bar{y}_{hij} \tag{16}$$

18 This may occur if a catch sampler samples a species or species group that are not otherwise observed in the creel interviews occurring on the same day, or if by happenstance a scheduled creel interview shift does not occur (for example, due to sampler illness).

19 Note that this equation represents an adaptation of equation 6 for averages or proportion estimates.

20 Note that this equation represents an adaptation of equation 11 for averages or proportion estimates.

which is then used to estimate the average across all sampled access locations by user group within each sampled day:

$$\bar{y}_{hi} = \frac{\sum_{j=1}^{q_i} \bar{y}_{whij}}{q_i} \tag{17}$$

This average will then be weighted by the relative 'size' of each sampled day compared to all other days sampled. The second-stage sampling weights to be used for weighting across days will be calculated directly from the estimates of the number of fish harvested as follows:

$$\tilde{w}_{2hi} \approx \frac{\tilde{N}_{hi}}{\bar{\tilde{N}}_h} \tag{18}$$

where $\tilde{N}_{hi}$ is the approximate index of the number of fish harvested by each species or species group for each sampled day as calculated by[21]:

$$\tilde{N}_{hi} = Q_i \bar{\tilde{N}}_{hi} \tag{19}$$

where Q_i is the number of access locations that could have been sampled within each day and $\bar{\tilde{N}}_{hi}$ is the approximate average number harvested (across all sampled locations for both creel and catch technicians) from Equation 14.

and $\bar{\tilde{N}}_h$ is the approximate average index of the number harvested across sampled days calculated as[22]:

$$\bar{\tilde{N}}_h = \frac{\sum_{i=1}^{d} \tilde{N}_{hi}}{d} \tag{20}$$

where d is the number of days sampled for each major port (across all locations for both creel and catch technicians).

The final step for estimating the averages or proportional parameters involve applying the weight derived in Equation 18 to each of the averages from Equation 17 as follows:

$$\bar{y}_{whi} = w_{2hi}\bar{y}_{hi} \tag{21}$$

which is then used to estimate the average across all sampled days by user group:

$$\bar{y}_h = \frac{\sum_{j=1}^{d} \bar{y}_{whi}}{d} \tag{22}$$

[21] Note that this equation represents an adaptation of equation 12 for averages or proportion estimates.
[22] Note that this equation represents an adaptation of equation 23 for averages or proportion estimates.

The overall number of fish harvested by each species or species group is obtained as follows (again only using the creel interview data), first by calculating the average number harvested across sampled days:

$$\bar{\hat{N}}_h = \frac{\sum_{i=1}^{d} \hat{N}_{hi}}{d} \tag{23}$$

where $\hat{N}_{hi}$ is from Equation 12.

Then the $\bar{\hat{N}}_h$ term is used to expand up to the index of the number of fish harvested by user group (guided versus unguided) for the surveyed season, as follows:

$$\hat{N}_h = D\,\bar{\hat{N}}_h \tag{24}$$

where D is the number of days covering the survey for the time period requested.

The $\bar{y}_h$ from Equation 22, which represents the estimate for the intrinsic parameter for averages or proportions to be used to expand into the yearly preliminary values, in summary, will be calculated as follows:

$$\bar{y}_h = \frac{1}{d_m}\sum_{i=1}^{d_m}\left(\frac{w_{2hi}}{q_{mi}}\sum_{j=1}^{q_{mi}}\left(\frac{\tilde{w}_{3hij}}{b_{mhij}}\sum_{k=1}^{b_{mhij}}\left(\frac{w_{4hijk}}{n_{mhijk}}\sum_{o=1}^{n_{mhijk}} y_{hijko}\right)\right)\right) \tag{25}$$

Summarizing the overall harvest index value by user group is calculated as (equivalent to Equation 24):

$$\hat{N}_h = \frac{D}{d}\sum_{i=1}^{d}\left(\frac{Q_i}{q_i}\sum_{j=1}^{q_i}\left(\hat{B}_{hij}\,\frac{\sum_{k=1}^{b_{hij}} N_{hijk}}{b'_{hij}}\right)\right) \tag{26}$$

The variance of this harvest index by user group (for each species or species group) will be approximated using the standard 3-stage equation (adapted from Sukhatme et al. 1984)[23]:

$$\hat{V}\left[\hat{N}_h\right] \approx \left\{(1-f_1)D^2\frac{S_{1h}^2}{d}\right\} + \left\{f_1\frac{D^2}{d\,d'}\sum_{i=1}^{d'}(1-f_{2i})\,Q_i^2\,\frac{S_{2hi}^2}{q_i}\right\} + \left\{f_1\frac{D^2}{d^2}\sum_{i=1}^{d}f_{2i}\frac{Q_i^2}{q_i q_i'}\sum_{j=1}^{q_i'}(1-f_{3ij})\left(\hat{B}_{hij}\right)^2\frac{S_{3hij}^2}{b_{hij}'}\right\} \tag{27}$$

where: f_1, f_{2i}, and f_{3ij} are the sampling fractions for days, access locations, and boat parties, respectively (i.e., $f_1 = d/D; f_{2i} = q_i/Q_i; f_{3ij} \approx b_{ij}'/\hat{B}_{ij}$)[24]; S_{1h}^2, S_{2hi}^2, and S_{3hij}^2 equal the: (1) among day, (2) among access location (within day), and the (3) among boat party (within access location) variance components for the harvest index, respectively, which are obtained as:

$$S_{1h}^2 = \frac{\sum_{i=1}^{d}\left(\hat{N}_{hi} - \bar{\hat{N}}_h\right)^2}{d-1} \qquad S_{2hi}^2 = \frac{\sum_{j=1}^{q_i}\left(\hat{N}_{hij} - \bar{\hat{N}}_{hi}\right)^2}{q_i - 1} \qquad S_{3hij}^2 = \frac{\sum_{k=1}^{z_{hij}}\left(N_{hijk} - \bar{N}_{hij}\right)^2}{b_{hij}' - 1} \tag{28}$$

where d' is the number of days in which S_{2hi}^2 can be estimated (i.e., days with at least 2 access locations sampled); and q_i' is the number of locations in which S_{3hij}^2 can be estimated (i.e., locations with either: (1) at least 2 boat parties interviewed, or (2) the number of sport fishing boat parties interviewed equals the estimated number of exiting sport fishing boat parties: $b_{ij}' = \hat{B}_{ij}$).

The variance for the average or proportional parameter estimates (for the average calculated in Equation 25), is approximated by the standard 4-stage equation for averages (adapted from Sukhatme et al. 1984), as follows:

[23] Note that the estimates of harvest (the N terms) collapse to a 3-stage sample survey estimation as the terminal sampling stage for the numbers of fish by species or species group is the sampled boat party (not the individual fish sampled).

[24] Note that the sampling fraction for sport fishing boat parties is estimated, as some boats are not intercepted and classified as either sport fishing or nonsport fishing boats. However, nearly all boats both interviewed and not interviewed, are generally classified as either sport fishing or nonsport fishing boats (i.e., very few unknowns), therefore the use of an estimate of the sampling fraction for this stage was deemed appropriate.

$$
\begin{aligned}
\hat{V}[\bar{y}_h] \approx & \left\{ (1 - f_{m1}) \frac{s_{1h}^2}{d_m} \right\} \\
& + \left\{ f_{m1} \frac{1}{d_m\ d''_m} \sum_{i=1}^{d''_m} (1 - f_{m2i})\, (w_{2hi})^2\, \frac{s_{2hi}^2}{q_{mi}} \right\} \\
& + \left\{ f_{m1} \frac{1}{d_m{}^2} \sum_{i=1}^{d_m} f_{m2i}\, \frac{1}{q_{mi}\ q''_{mi}} (w_{2hi})^2 \sum_{j=1}^{q''_{mi}} (1 - f_{m3ij}) (\tilde{w}_{3hij})^2\, \frac{s_{3hij}^2}{b_{hij}} \right\} \\
+ & \left\{ f_{m1} \frac{1}{d_m{}^2} \sum_{i=1}^{d} f_{m2i}\, \frac{1}{q_{mi}^2} (w_{2hi})^2 \sum_{j=1}^{q_{mi}} f_{m3ij}\, \frac{1}{b_{mhij}\ b''_{mhij}} (\tilde{w}_{3hij})^2 \sum_{k=1}^{b'_{mhij}} (1 - f_{4hijk})\, (w_{4hijk})^2\, \frac{s_{4hjik}^2}{n_{mhijk}} \right\}
\end{aligned}
\tag{29}
$$

where: f_{m1}, f_{m2i}, f_{m3ij}, and f_{4hijk} are the sampling fractions for days, access locations, boat parties, and fish respectively (i.e., $f_{m1} = d_m / D; f_{m2i} = q_{mi} / Q_i; f_{m3ij} \approx b_{mij} / \hat{B}_{ij}$; $f_{4hijk} = n_{mhijk} / N_{mhijk}$); where f_{m3ij} is the sampling fraction for sport fishing boat parties for the estimation of averages and proportions (i.e., $f_{m3ij} \approx b_{mij} / \hat{B}_{ij}$, where b_{mij} is the number of boat parties in which the species or species group had bags measured for the proportion or average regardless of user group); f_{4hijk} is the sampling fractions for fish by species or species group within a sampled boat party (i.e., $f_{4hijk} = n_{mhijk} / N_{mhijk}$) which by design should equal one (and therefore the fourth major term of equation 29 should resolve to zero); the s_{1h}^2, s_{2hi}^2, s_{3hij}^2, and s_{4hijk}^2 terms equal the (1) among day, (2) among access location (within day), (3) among boat party (within access location), and (4) among fish (within boat party) variance components for the average or proportion estimate, respectively, which will be obtained as:

$$
s_{1h}^2 = \frac{\sum_{i=1}^{d_m} \left(\bar{y}_{whi} - \bar{y}_h \right)^2}{d_m - 1} \qquad s_{2hi}^2 = \frac{\sum_{j=1}^{q_{mi}} \left(\bar{y}_{whij} - \bar{y}_{hi} \right)^2}{q_{mi} - 1}
$$

$$
s_{3hij}^2 = \frac{\sum_{k=1}^{b_{mhij}} \left(\bar{y}_{whijk} - \bar{y}_{hij} \right)^2}{b_{mhij} - 1} \qquad s_{4hijk}^2 = \frac{\sum_{o=1}^{n_{mhijk}} \left(y_{hijko} - \bar{y}_{hijk} \right)^2}{n_{mhijk} - 1} \tag{30}
$$

d'' is the number of days in which s_{2hi}^2 can be estimated (i.e., days with at least 2 access locations sampled); q''_i is the number of locations in which s_{3hij}^2 can be estimated (i.e., locations with either (1) at least 2 boat parties interviewed or (2) the number of sport fishing boat parties interviewed equals the estimated number of exiting sport fishing boat parties: $b'_{ij} = \hat{B}_{ij}$); and b''_{mhij} is the number of sport fishing boat parties in which s_{4hijk}^2 can be estimated (at least 2 fish measured per species or species group or all fish harvested by the sport fishing boat party sampled).

Across user group (guided versus unguided), biweek, or across port estimates of the numbers of fish harvested by species or species group and the associated variances can be obtained by summation:

$$\hat{N} = \sum_{h=1}^{L} \hat{N}_h \qquad \text{and} \qquad \hat{V}\left[\hat{N}\right] \approx \sum_{h=1}^{L} \hat{V}\left[\hat{N}_h\right] \tag{31}$$

where the terms $\hat{N}_h$ and $\hat{V}\left[\hat{N}_h\right]$ are as calculated above in Equations 26 and 27, respectively; and L is the number of strata to combine (equal to 2 if the combination is just involving user groups, or more if involving combining of port estimates). Note that the overall across user group variance estimate is only approximate as it does not factor in the covariance for that level of post-stratification. Because the guided versus unguided level of stratification is a post-stratification classification, these components are not independently sampled and as such they are not statistically independent as are the 'pre-stratification' classification of individual ports, therefore the variance equation above is only approximate. Accordingly, if across user group estimates of the numbers of fish harvested are desired then an alternative approach that addresses the covariance issue is to ignore the user group distinction when applying the data to Equations 26 and 27.

Across user group (guided versus unguided) or across port estimates of the average or proportions are weighted by the stratum weights of the corresponding stratum, as follows:

$$\bar{y} = \sum_{h=1}^{L} \hat{W}_h \bar{y}_h \qquad \text{where} \qquad \hat{W}_h = \frac{\hat{N}_h}{\hat{N}} \tag{32}$$

where the terms $\hat{N}_h$ reference the stratum estimates of the number of fish harvested (or caught) from Equation 26; and $\hat{N}$ references the across strata estimate from Equation 31. The variance of $\bar{y}$ will be estimated approximately[25] as:

$$\hat{V}\left[\bar{y}\right] \approx \sum_{h=1}^{L} \hat{W}_h^2 \, V\left[\, \bar{y}_h \right] \tag{33}$$

Standard errors of the estimates will be obtained simply by taking the square root of the appropriate variance estimate.

As with the variance estimate for across-user-group estimates of the index of the number of fish harvested, these across-variance estimates for the average or proportional parameter estimates are only approximate due to the covariance terms that are not explicitly calculated. An evaluation of the necessity of incorporating the covariance terms was conducted during the data analysis phase for this project in 2018. It was determined that the covariances on estimates that involve averages and proportions were trivial for all species with a few exceptions. Those exceptions included species that have different size regulation based on guided and unguided harvest, although the exceptions did not involve all ports. In light of this it was determined that the variance in equation 33 is most appropriate.

[25] As with the variance estimate for across user group estimates of the index of the number of fish harvested, these across variance estimates for the average or proportional parameter estimates are only approximate due to the covariance terms that are not explicitly calculated. An evaluation was done in 2018 which determined this equation was appropriate.

CWT Contribution Estimating Equations

Hatchery and tagged wild stock contributions and variances will be estimated for the surveys using the procedures outlined by Bernard and Clark (1996). Where the number of a species sampled are the number of that species whose adipose fin is physically inspected. The number of a species harvested for a particular time period t is denoted $\widehat{N}_t$ The time period may stand for the entire season or part for example when estimating early District 108 or 111 harvest. Post season, and once the SWHS is published "final estimates" of cwt harvest can be calculated using the estimate of harvest and variance from the SWHS for $\widehat{N}_t$ for the entire season. There should be caution used when using a very small time periods since that will restrict the number of samples with which to base your estimates on, and one may find no harvest is estimated or alternatively that the estimated number of fish harvested from a particular CWT stock is greater than all of the sport fish harvest of all stocks. This phenomenon is sometimes found when estimating the harvest for small time periods in commercial fisheries too, such as the trawl fishery.

The estimating procedures by Bernard and Clark (1996) that will be used are those appropriate for estimating contributions and variances when total harvest is estimated.

The notation used in the following equations essentially follows that used by Bernard and Clark (1996), with subscripts adapted to avoid confusion with other subscripts used in this operational plan. The first step involves estimating the contribution to each time period in the fishery of each particular tag code. Both the catch sampling and creel sampling data are used within each time period for all the corresponding terms of the equations below, except where noted (e.g., creel samples only):

$$\hat{r}_{tc} = \hat{N}_t \hat{p}_{tc} \theta_c^{-1}, \tag{34}$$

where $\hat{r}_{tc}$ equals the estimated number of salmon from a hatchery (or wild stock) release identified by the unique tag code *c*, harvested in time period *t*; $\hat{N}_t$ is the estimated total harvest index of salmon (one particular species only) for time period *t*, calculated by applying Equation 31 using the corresponding <u>creel samples only</u> from each time period separately and summing across the 2 user group (guided and unguided) components of the harvest index; θ_c is the proportion of a particular release that contained a CWT of the unique tag code *c*; and $\hat{p}_{tc}$, the estimated fraction of CWT fish caught in time period t that are from cohort c, is calculated as follows:

$$\hat{p}_{tc} = \frac{m_{tc}}{\lambda_t n_t}, \tag{35}$$

where n_t is the number of salmon (1 particular species only) inspected for missing adipose fins from the sampled harvest in time period *t*; corresponding to summing all of the n_{mhijk} terms (as defined for Equation 1) for Chinook or coho salmon inspected for missing adipose fins from all samples within a time period; m_{tc} equals the number of CWTs dissected out of the salmon heads and decoded as the unique tag code *c*, originally sampled from time period *t*; and λ_t is defined as follows:

$$\lambda_t = \frac{a_t^{'} t_t^{'}}{a_t t_t}, \tag{36}$$

where a_t is the number of salmon with a missing adipose fin that were counted from the sampled fish in time period *t*; $a_t^{'}$ equals the number of salmon heads previously marked with a head strap that arrived at the Tag Lab from fish originally sampled from time period *t*; t_t is the number of CWTs that were detected in the salmon heads at the Tag Lab from those salmon sampled in time period *t*; and $t_t^{'}$ equals the number of CWTs that were removed from the salmon heads and decoded, from those salmon sampled in time period *t*.

Estimates of across-time period contributions by tag code, as well as by combined tag codes (e.g., all Alaskan hatchery tag codes) will be obtained by summing the estimates across time periods and tag codes, as appropriate:

$$\hat{R} = \sum_t \sum_c \hat{r}_{tc} \tag{37}$$

The estimated relative contribution of a particular tag code or across tag codes is then calculated by dividing through by the corresponding harvest index values for the entire season at a particular access location, as follows:

$$\hat{u}_c = \frac{\sum_t \hat{r}_{tc}}{\sum_t \hat{N}_t} \quad \text{and} \quad \hat{U} = \frac{\hat{R}}{\sum_t \hat{N}_t}, \tag{38}$$

where the $\hat{u}_c$ and $\hat{U}$ terms are the proportional contribution estimates that can then be applied to the projected SWHS estimates of overall Chinook or coho salmon harvest to calculate the corresponding preliminary values for these parameters.

Estimates of the variance for contributions in a time period will be estimated following the approach outlined by Bernard and Clark (1996):

$$\hat{V}\left[\hat{r}_{tc}\right] = \hat{r}_{tc}^{2} \left\{ \frac{\hat{V}\left[\hat{p}_{tc}\right]}{\hat{p}_{tc}^{2}} + \frac{\hat{V}\left[\hat{N}_t\right]}{\hat{N}_t^{2}} - \frac{\hat{V}\left[\hat{p}_{tc}\right]\hat{V}\left[\hat{N}_t\right]}{\hat{p}_{tc}^{2}\ \hat{N}_t^{2}} \right\}, \tag{39}$$

where $\hat{V}\left[\hat{N}_t\right]$ equals the estimated variance of the overall harvest index estimate for time period *t*, calculated by applying Equation 31 using the corresponding creel samples only from each time period separately, and summing across the guided and unguided components of the harvest index variance; and $\hat{V}\left[\hat{p}_{tc}\right]$ is the variance of $\hat{p}_{tc}$, which is estimated approximately using the large-sample approximation formula in Bernard and Clark (1996: their Equation 12). The large-sample approximation will be used because the data collected in the similarly designed surveys conducted in 1995 indicated that this approximation is relatively accurate for this survey:

$$\hat{V}\left[\hat{p}_{tc}\right] \approx \frac{\hat{p}_{tc}}{\lambda_t n_t}\left(1 - \lambda_t \hat{\phi}_t \theta_c\right), \tag{40}$$

where

$$\hat{\phi}_t = n_t / \hat{N}_t \ . \tag{41}$$

Estimates of the variance of across-time period contributions by tag code, as well as by combined tag codes will be obtained by the following equation (adapted from Equation 3 in Bernard and Clark 1996):

$$\hat{V}\left[\hat{R}\right] = \sum_t \sum_c \hat{V}\left[\hat{r}_{tc}\right] + 2\sum_t \sum_c \sum_{u>c} \widehat{Cov}\left[\hat{r}_{tc}, \hat{r}_{tu}\right], \tag{42}$$

where $\widehat{Cov}\left[\hat{r}_{tc}, \hat{r}_{tu}\right]$ is the estimated covariance between the estimated contribution of 2 different tag codes within each time period, which will be calculated from Equation 43 below. Equation 42 is adapted from Equation 14 from Bernard and Clark (1996), and is again the large-sample approximation that was demonstrated to be relatively accurate with the 1995 data:

$$\widehat{Cov}\left[\hat{r}_{tc}, \hat{r}_{tu}\right] \approx \hat{r}_{tc}\hat{r}_{tu} \frac{\hat{V}\left[\hat{N}_t\right]}{\hat{N}_t^2}. \tag{43}$$

Finally, the variance for the relative contribution terms (*u* and *U* terms as defined in Equation 38) will be approximated using parametric boot strapping (Efron and Tibshirani 1993). For each of at least 10,000 iterations of the bootstrap simulation (denoted by the subscript b) a sample R_b^* will be drawn from the normal distribution$\sim N\left(\hat{R}, \hat{V}\left(\hat{R}\right)\right)$, and a sample N_b^* will be drawn from the normal distribution $\sim N\left(\hat{N}, \hat{V}\left(\hat{N}\right)\right)$. For each iteration the statistic:

$$U^* = \frac{R^*}{N^*} \tag{44}$$

will be computed. The variance of $\hat{U}$ will be estimated by the sample variance of the 10,000 U^* simulated values. Standard errors will be obtained as the square root of the appropriate variance. If the harvest of CWT fish and the harvest of all fish of that species are positively correlated this method may overestimate the variance.

Yearly Preliminary Estimates

The approach for estimating the yearly preliminary values associated with the objectives for this project involves applying the estimates of the intrinsic average and proportion parameters to a projection of the appropriate harvest (or in some cases total catch) for the SWHS. The projection of the harvest will be obtained by expanding the harvest indices (as in Equation 26) by an expansion factor estimated from the most recent 5-year expansion ratio calculated from the SWHS harvest estimates to this projects' corresponding harvest estimates.

The expansion ratios are calculated as an across-year average by user group (guided versus unguided, or combined), with on-site data and estimates from ports combined within each SWHS survey area (e.g., Petersburg and Wrangell would be combined for SWHS Survey Area C):

$$\bar{\pi}_h = \frac{\sum_{p=1}^{z} \hat{\pi}_{hp}}{z} \quad \text{or by user group combined:} \quad \bar{\pi} = \frac{\sum_{p=1}^{z} \hat{\pi}_p}{z}, \tag{45}$$

where z is the number of years to average over (set to 5 years[26]); the $\hat{\pi}_{hp}$ and $\hat{\pi}_{p}$ terms are the corresponding estimated ratios for each year p by user group, calculated as follows:

$$\hat{\pi}_{hp} = \frac{\hat{H}_{hp}}{\hat{N}_{hp}} \quad \text{or by user group combined:} \quad \hat{\pi}_{p} = \frac{\hat{H}_{p}}{\hat{N}_{p}} \tag{46}$$

where $\hat{H}_{hp}$ and $\hat{H}_{p}$ are the corresponding estimates from the SWHS for year p; $\hat{N}_{hp}$ is the on-site harvest index for each year across each user group for lingcod, rockfish, and halibut (obtained from Equation 26); and $\hat{N}_{p}$ is the across user group harvest index for Chinook and coho salmon[27] for each corresponding year (obtained from Equation 31).

The projected harvest (i.e., preliminary SWHS estimate) is then obtained by applying the across year ratio to this year's harvest index as follows, by user group:

$$\tilde{H}_{h} = \bar{\pi}_{h}\ \hat{N}_{h} \quad \text{or by user group combined:} \quad \tilde{H} = \bar{\pi}\ \hat{N} \tag{47}$$

where $\hat{N}_{h}$ and $\hat{N}$ are from Equations 26 and 31, respectively for this year's data. We cannot sample in every site or at all ports within an SWHS area, although we assume we are getting a representative sample from each SWHS area.

The variance of $\tilde{H}_{h}$ will be estimated (Goodman 1960) by user group:

$$\hat{V}\left[\tilde{H}_{h}\right] = \hat{N}_{h}^{2}\ \hat{V}\left[\bar{\pi}_{\psi h}\right] + \bar{\pi}_{\psi h}^{2}\ \hat{V}\left[\hat{N}_{h}\right] - \hat{V}\left[\bar{\pi}_{\psi h}\right]\hat{V}\left[\hat{N}_{h}\right] \tag{48a}$$

or by user group combined:

$$\hat{V}\left[\tilde{H}\right] = \hat{N}^{2}\ \hat{V}\left[\bar{\pi}_{\psi}\right] + \bar{\pi}_{\psi}^{\ 2}\ \hat{V}\left[\hat{N}\right] - \hat{V}\left[\bar{\pi}_{\psi}\right]\hat{V}\left[\hat{N}\right], \tag{48b}$$

where $\hat{V}\left[\hat{N}_{h}\right]$ and $\hat{V}\left[\hat{N}\right]$ are from Equations 27 and 31, respectively for this year's data; and the $\hat{V}\left[\bar{\pi}_{\psi h}\right]$ and $\hat{V}\left[\bar{\pi}_{\psi}\right]$ terms are the variances for prediction including two uncertainty components, the process error ($V[\pi]$: the variation across years in the π's) and the sampling variance of $\bar{\pi}$ ($V[\bar{\pi}]$).

The variance estimates of expansion ratio for prediction $\hat{V}\left[\bar{\pi}_{\psi}\right]$ will be derived using parametric bootstrapping (Efron and Tibshirani 1993). For each bootstrap iteration (denoted by subscription b), a sample $\hat{H}^{*}_{p,b}$ will be drawn from the normal distribution $N(\hat{H}_{p}, V[\hat{H}_{p}])$ for each year p of the total z years. Similarly, a sample $\hat{N}^{*}_{p,b}$ will be drawn from the normal distribution

[26] The 5 most recent complete pairs of estimates from the on-site and SWHS data are used to estimate the expansion ratio due to the progressive nature of the corresponding study designs for the 2 projects. For example, the coverage of the on-site survey has probably decreased in magnitude because the number of charter boat-based lodges located away from accessible sampling locations have increased. Accordingly, the most recent data pairs are expected to be better predictors for expansion in the current year. An evaluation of using a time series approach to estimate the expansion ratio may be evaluated to determine if a more accurate expansion ratio would result (i.e., projections closer to final SWHS estimates), in the following years.

[27] For CWT-sampled Chinook and coho salmon user group (guided versus unguided) are combined; accordingly, for those species, the expansion factors ignore the user group distinction (and are derived by the total SWHS harvest and on-site harvest index regardless of user group)

$N(\hat{N}_p, V[\hat{N}_p])$ for year *p*. A ratio estimate $\hat{\pi}^*_{p,b}$ will then be calculated for each year *p* using equation:

$$\hat{\pi}^*_{p,b} = \frac{\hat{H}^*_{p,b}}{\hat{N}^*_{p,b}}. \tag{49}$$

A bootstrap value $\hat{\pi}^*_b$ is randomly selected from these *z* values of $\hat{\pi}^*_{p,b}$. Then a bootstrap sample of size *z* is drawn from the *z* values of $\hat{\pi}^*_{p,b}$ by sampling with replacement, and a mean ($\bar{\pi}^*_b$) of this bootstrap sample is calculated.

After a large number (*B*= 100,000) of bootstrap iterations are conducted, the sample variance($\hat{V}[\hat{\pi}^*_b]$) of bootstrap values $\hat{\pi}^*_b$ and the sample variance ($\hat{V}[\bar{\pi}^*_b]$) of bootstrap value $\bar{\pi}^*_b$ will be calculated, respectively. The variance estimate of expansion ratio for individual year *p* ($\hat{V}[\hat{\pi}_p]$) will be calculated as the sample variance of *B* iterations of $\hat{\pi}^*_{p,b}$. Finally, the variance estimate of expansion ratio for prediction will be calculated using equation:

$$\hat{V}[\bar{\pi}_\psi] = \hat{V}[\hat{\pi}^*_b] - \frac{\sum_{p=1}^{z} \hat{V}[\hat{\pi}_p]}{z} + \hat{V}[\bar{\pi}^*_b] \tag{50}$$

,with the first two term accounting for the process error and the last term accounting for the sampling variance of $\bar{\pi}$ .The variance estimates of expansion ratio for prediction by user group $\hat{V}\left[\bar{\pi}_{\psi h}\right]$ can be calculated in the same way by replacing the corresponding variables in equations (49) through (50) with the variables by user group.

Composition of Harvest Estimates (Secondary objective 12)

The SWHS does not provide individual species estimates for rockfish. However, a preliminary estimate and variance of harvest can be applied by substituting $\widehat{N}_{sh}$ in for $\widehat{N}_h$ in Equations 26 and 27 where $\widehat{N}_{sh}$ is the estimate of harvest of the species s in stratum h of interest as calculated by this project. The expansion ratio $\bar{\pi}_h$ will be that which is used for the entire species or species grouping. For rockfish it will be the port/location specific expansion ratio for all rockfish harvest combined.

For instances where a final harvest estimate is desired using the composition from this program and the harvest estimate from the SWHS program (which is publish over a year after harvest has occurred), then one may calculate estimates in the following manner.

Let $\hat{N}_{sh}$ be the individual harvest index value (i.e. from Equation 26) for species or stock group *s*, *stratum h*; and *S* is the total number of different s groups for the appropriate overall total harvest. $\hat{V}\left[\hat{N}_{sh}\right]$ is calculated per Equation 27 for the corresponding s group.

Let $\hat{\delta}_{sh}$ be the estimated proportion of the particular s group within each SWHS Survey Area which can be calculated as:

$$\hat{\delta}_{sh} = \frac{\hat{N}_{sh}}{\sum_{s=1}^{S} \hat{N}_{sh}}, \tag{51}$$

The variance of $\hat{\delta}_{sh}$ calculated approximately using parametric boot strapping (Efron and Tibshirani 1993). For each of at least 10,000 iterations of the bootstrap simulation (denoted by the subscript b) a sample N_b^* will be drawn from the normal distribution$\sim N\left(\widehat{N}_{sh}, \hat{V}\left(\widehat{N}_{sh}\right)\right)$, and a sample $N_{sum,b}^*$ will be drawn from the normal distribution $\sim N(\sum \widehat{N}_{sh}, \hat{V}(\sum \widehat{N}_{sh}))$ For each iteration the statistic:

$$\delta^* = \frac{N_b^*}{N_{sum,b}^*} \tag{52}$$

will be computed. The variance of $\hat{\delta}_{sh}$will be estimated by the sample variance of the 10,000 δ^* simulated values. For species that make up a large percentage of harvest, harvest of species is positively correlated with harvest of all rockfish. In this instance this method may overestimate the variance.

This proportion can be applied to the SWHS Harvest estimate and the variance calculated by the formula by Goodman (1960) for the variance of a product of random variables:

$$\hat{V}\left(\widehat{N}_{s,swhs}\right) = \hat{\delta}_{sh}^2 \hat{V}\left(\widehat{N}_{swhs}\right) + \hat{V}\left(\hat{\delta}_{sh}\right)\widehat{N}_{swhs}^2 - \hat{V}\left(\hat{\delta}_{sh}\right)\hat{V}\left(\widehat{N}_{swhs}\right) \tag{53}$$

Midseason Projections

Midseason projections for the yearly end-of-season preliminary values are estimated in a similar manner as described for the **Yearly Preliminary Estimates**, with the additional step of expanding the data and estimates through the end of the appropriate midseason period by historical ratios for the midseason period to the total yearly estimate. For example, if by July 31st, *Y*% of the harvest of yelloweye rockfish has historically occurred before that date, then the harvest index for yelloweye rockfish through the beginning of August would then be expanded upwards by multiplying by the factor of "*100/Y*". Then the equations above (45 through 53) would be applied to this expanded projection of the end-of-season on-site harvest index to obtain the end-of-season preliminary value. Because these values are used for inseason management milestones at this time, the midseason estimates will be calculated without corresponding estimates of the variances.

Preliminary Yearly Total Sport Harvest of Chinook and Coho Salmon (Primary Objectives 1a and 2a)

The preliminary yearly total sport harvest of Chinook and coho salmon for SEAK will be estimated by the following step-wise process (implemented separately for each species):

1) Estimates of the harvest index for each user group (guided versus unguided) for each port will be calculated using Equation 26, with corresponding variances approximated by Equation 27.

2) The user group harvests will be summed across type (guided plus unguided) for each port, with the variances for these sums approximated by summation (an approximation because the 2 parameters are not estimated independently) using Equation 31.
3) The estimates for SWHS Survey Areas with more than 1 sampled port will be combined by summation and therefore the estimates for Petersburg and Wrangell will be combined to obtain 1 overall harvest index for SWHS Survey Area C; and Gustavus and Elfin Cove estimates will be combined for SWHS Survey Area G. The corresponding variances will also be summed using Equation 31.
4) Next, each SWHS Survey Area's harvest index will be expanded by the most recent 5-year expansion factor ratios for the following areas: Area A = Ketchikan, Area B = Craig-Klawock, *but note below about the east and west sides of Prince of Wales Island*, Area C = Petersburg-Wrangell, Area D = Sitka, Area E = Juneau, Area G = Gustavus-Elfin Cove, and Area H = Yakutat as outlined in Equation 47 (for Chinook and coho user groups are combined). Variances will be calculated as noted in Equations 48 through 50.

   In the Ketchikan area, the expansion factor calculation will take into account harvests from the east side of Princes of Wales Island (a portion of SWHS Survey Area B) because much of the harvest in this area is taken by anglers accessing the fishery from the Ketchikan road system. Similarly, this same portion of SWHS Survey Area B has been "removed" from the expansion factor calculation for expanding the Craig-Klawock harvests.
5) In the next step, each of these expanded projections for the current year's SWHS preliminary values will be summed over each SWHS Survey Area (A through E, G, and H), with variances summed as well.
6) The final step will be to adjust for SWHS Survey Area F (Haines-Skagway), which historically has a low overall Chinook and coho salmon harvest; this expansion comes from the ratio of the percentage of harvest by each species in Area F to the total of SWHS SEAK harvest estimates (SWHS Survey Areas A through H). So, for example, if the Area F harvest of Chinook salmon represents Y% of the total SEAK harvest, then the total current year's preliminary harvest value for all areas except F would be expanded by dividing by "1-(Y/100)" (e.g., if Y% = 4%, then divide the summation obtained in Step 5 by 0.96). The end result will represent the total preliminary yearly value of the harvest by each species. The variance from Step 5 would be multiplied by the square of the expansion (e.g., $(1/0.96)^2$ in the example above) to get the variance of this total (with the standard error equal to the square of the variance).

Hatchery and Non-hatchery Contributions for Chinook and Coho Salmon (Primary Objectives 1b and 2b)

Estimates of the relative and preliminary total harvest contributions of hatchery and nonhatchery CWT-tagged Chinook salmon stocks (Primary Objective 1b) and coho salmon stocks (Primary Objective 2b) will be calculated in a stepwise manner as follows, implemented separately for each species, and each tag code or combinations of tag code (e.g., all Alaska hatchery codes):

1) Estimates of the relative contribution by tag code or combination of tag code will be calculated as outlined in Equation 38, with the variance calculated as in Equation 44. These estimates are calculated with statistics combined across ports that are within the same SWHS Survey Areas in the same grouping manner as described above. The relative

contribution estimates by port (or combined port) correspond to the objective criteria listed for Primary Objectives 1b and 2b.

2) For the preliminary total harvest by tag code or combination of tag code estimates of preliminary total harvest by species will be entered into equations 34-43 and estimates and variances calculated accordingly

3) The total contribution estimates by tag code or combined tag code for each species over all survey areas will be obtained by summation across SWHS Survey Areas in a similar manner as described above for the Preliminary Yearly Total Sport Harvest, with variances obtained by summation.

Pacific Salmon Treaty Harvest (Secondary Objective 1)

An *approximation* of the projected Pacific Salmon Treaty harvest (Chinook salmon) can be estimated for SEAK by estimates produced by this project. The term approximation is used since the projected Pacific Salmon Treaty harvest involves allocating harvest referred to as "add on" across different gear types. Therefore, the preliminary and final estimate of PST harvest is only calculated by John Carlile, (Fishery Scientist) and David Leonard, (Biometrician) of the Division of Commercial Fisheries. The calculation involves taking the total estimated harvest and subtracting off the lower 90% CI bound of the AK hatchery contribution and then that approximation may be used.

Justification and steps for calculating the early season (late April through mid-July) Pacific Salmon Treaty harvest for DCF Salmon Districts 108 (Petersburg/Wrangell) and 111 (Juneau), follows. Note that in both cases, due to the nature of this information need for addressing Pacific Salmon Treaty requirements inseason, no estimates of variance are required at this time.

DCF Salmon District 108

The Pacific Salmon Treaty requires the U.S. delegation (and in this case, Alaska in particular) to provide weekly estimates of the number of wild Stikine River large (≥28 in) Chinook salmon harvested in District 108 by both sport and commercial fishermen during late April to mid-July. Large Chinook salmon sport harvest in District 108 is sampled onsite at the ports of Petersburg (north end of District 108) and Wrangell (south end of District 108), and the onsite technicians summarize the District 108–specific information as part of their weekly paperwork. Recoveries of CWTs from large Chinook salmon in District 108 areas from the weekly sport fisheries are used to estimate the relative contribution of Alaska and non-Alaska hatchery fish, and non-Alaska wild fish. The total Alaska wild large Chinook salmon harvest is estimated by subtracting the estimated number of Alaska and non-Alaska hatchery fish, and non-Alaska wild fish from the estimated total harvest. The most recent, available 5-year average[28] of the expansion factor for each port is applied to the relative estimates to project the total harvest of District 8 large Chinook salmon.

DCF Salmon District 11

The Pacific Salmon Treaty requires the U.S. delegation (and in this case, Alaska in particular) to provide weekly estimates of the number of wild Taku River large (≥28 in) Chinook salmon harvested in District 111 by both sport and commercial fishermen during late April to early July. Large Chinook salmon harvested in District 111, which includes the majority of the Juneau-area

[28] For purposes of this plan (and germane to both Districts 108 and 111), the analyses was based on the 2011 – 2015 data; in subsequent years, the most recent 5-year time period will be used.

marine waters, are sampled onsite at the port of Juneau. In addition to the docks and boat launches sampled during mid-April to the end of May, the unique shoreline Chinook salmon fishery at Picnic Cove on the north end of Douglas Island is sampled as it occurs in District 111. The District 111 harvest information is the majority of the entire harvest encountered by onsite personnel in Juneau, so the data are examined and any Chinook salmon information from outside of District 111 is excluded. Recoveries of CWTs from large Chinook salmon from District 111 areas from the weekly sport fisheries are used to estimate the relative contribution of Alaska and non-Alaska hatchery fish, and non-Alaska wild fish. The total wild large Chinook salmon harvest is estimated by subtracting the estimated number of Alaska and non-Alaska hatchery fish, and non-Alaska wild fish from the estimated total harvest. A separate expansion factor for Juneau is used to expand the projected total harvest estimates for District 111.

Average Weight Estimates (Primary Objective 3) and Length Composition (Secondary Objective 6) of Pacific Halibut

Estimates of the mean net weights of halibut harvested at all sampled ports will be made by first converting each length measurement to net weight using the IPHC length-weight relationship:

$$\hat{W}_{hijko} = \alpha \, L_{hijko}^{\beta}, \tag{54}$$

where $\widehat{W}_{hijko}$ is the estimated net weight in pounds of each fish *o* in the *k*th sampled boat party's bag, at access location *j*, on the sampled day *i* for each user group *h* (guided versus unguided), the L_{hijko} is the fork length in centimeters for each halibut measured, and α and β are the estimated regression parameters for the length-to-weight conversion model endorsed by the IPHC (Clark 1992), with $\alpha = 6.921 \times 10^{-6}$ and $\beta = 3.24$. In this approach, the individual lengths for each fish are converted to weights rather than applying the conversion to a mean length as per the recommendations by Nielsen and Schoch (1980). No correction will be made for transformation bias because the length-weight relationship was based on a large sample and the residual variance is extremely small (William Clark, Quantitative Scientist, IPHC, Seattle WA, personal communication). Mean weight estimates are presented in pounds rather than kilograms because that is the standard unit used by halibut management agencies. The mean weight estimates by user group for each port or combined ports within each SWHS Survey Area are then calculated by substituting the converted weight values ($\hat{W}_{hijko}$) for the y_{hijko} term in Equation 25 resulting in the average net weight by user group at each port or combined port (the combined port estimates are produced by treating each access location at each port as if they were separate access locations in the combined port in the multistage calculations). The estimated variances for these averages will be approximated by a similar substitution into Equation 29, with standard errors calculated as the square root of the variances.

Average Weight and Preliminary Biomass Estimates of Lingcod (Primary Objective 4 and Secondary Objective 9)

The average round weight estimates for lingcod by user group (guided versus unguided) and user group combined for the ports of Sitka, Ketchikan, Craig-Klawock, Gustavus, Elfin Cove, and Yakutat will be calculated in the same manner as described above for the average weight of halibut. The corresponding estimates for the regression parameters are $\alpha = 7.9 \times 10^{-6}$ and $\beta = 3.07$ for round weight in kilograms, with total length measured in centimeters for use in Equation 56. The values for α and β are those used by the DCF (Dave Carlile, Herring and Groundfish Biometrician, ADF&G Juneau, personal communication, Jan 5, 2000). The mean weight estimates by user group and in total for each port or combined ports within each SWHS Survey Area are then calculated by substituting the converted weight values for the y_{hijko} term in Equation 25; the combined port estimates are produced by treating each access location at each port as if they were separate access locations in the combined port in the multistage calculations. The estimated variances for these averages will be approximated by similar substitution into Equation 29, with standard errors calculated as the square root of the variances.

The preliminary biomass estimate for each SWHS Survey Area will then be estimated by multiplying the average weights for each port (or combined ports within each SWHS Survey Area) by the corresponding preliminary harvest estimate (by user group and user group combined), as follows:

$$\tilde{W}_h = \overline{w}_h \, \tilde{H}_h \quad \text{and} \quad \tilde{W} = \overline{w} \, \tilde{H} \tag{55}$$

where $\overline{w}_h$ and $\overline{w}$ are the average weight estimates by user group and by user group combined as calculated by Equation 25 (with weight substituted for "y"); and $\tilde{H}_h$ and $\tilde{H}$ are equal to the preliminary harvest of lingcod in numbers of fish for each user group and user group combined as obtained by Equation 47. The variance of the estimated biomass will be calculated by the equation of Goodman (1960) as follows:

$$\hat{V}\left[\tilde{W}_h\right] = \overline{w}_h^2 \, \hat{V}\left[\tilde{H}_h\right] + \hat{V}\left[\overline{w}_h\right] \tilde{H}_h^2 - \hat{V}\left[\tilde{H}_h\right] \hat{V}\left[\overline{w}_h\right] \text{ and} \tag{56a}$$

$$\hat{V}\left[\tilde{W}\right] = \overline{w}^2 \, \hat{V}\left[\tilde{H}\right] + \hat{V}\left[\overline{w}\right] \tilde{H}^2 - \hat{V}\left[\tilde{H}\right] \hat{V}\left[\overline{w}\right] \tag{56b}$$

where $\hat{V}\left[\overline{w}_h\right]$ and $\hat{V}\left[\overline{w}\right]$ are from Equation 29; and $\hat{V}\left[\tilde{H}_h\right]$ and $\hat{V}\left[\tilde{H}\right]$ are from Equations 48a and 48b, respectively.

Rockfish Species Composition, Average Weight Estimates, and Preliminary Biomass Removals of Demersal Shelf Rockfish (Primary Objective 5 and Secondary Objectives 12a and 12b)

Species Composition of Rockfish

The species composition of rockfish will be estimated as proportions of the rockfish harvest at each port ($\hat{p}_{sg}$) (or combined ports within a SWHS Survey Area) and calculated as outlined in Equation 51, with corresponding variances from Equation 53.

Average Weight of Rockfish

The average weight for each rockfish species and species grouping by user group $\overline{w}_{sh}$ will be estimated as described above for halibut and lingcod. The parameters for converting lengths to weight were developed for major species in the harvest from paired length and weight data (sexes combined) collected by this project during 2006 and 2007. Parameters for species or species groups with low sample sizes are obtained from the fisheries literature (Table 7).

The preliminary harvest biomass of DSR by user group in the Southeast Outside District (Craig, Sitka, Gustavus, Elfin Cove, and Yakutat combined) and variances will be estimated as described above for lingcod, by applying Equations 55 through 56a and 56b to the corresponding terms for each individual DSR species separately. In applying these equations, the terms $\tilde{H}_h$ and $\hat{V}\left[\tilde{H}_h\right]$ will be replaced by the corresponding values for each DSR species; i.e., $\tilde{H}_{sh}$ and $\hat{V}\left[\tilde{H}_{sh}\right]$ as calculated in Equations 51 and 53, respectively. The preliminary estimate of the harvest biomass of all DSR species will be calculated as the sum of the individual harvest biomass estimates of each DSR species within each user group and across the corresponding ports. The overall variance will similarly be obtained by summation across the species and port values.

Table 7.–Coefficients for estimating round weight in kilograms from total length in centimeters for rockfish species to be employed in Southeast Alaska rockfish weight evaluation from sport fisheries.

Species or groups with large sample sizes	α	β	Species or groups with small sample sizes	α	β
Black	0.000109	2.495	Silvergrey	0.000060	2.586
Bocaccio	0.000057	2.614	Tiger	0.000030	2.839
Canary	0.000112	2.472	Vermilion	0.000183	2.373
China	0.000066	2.643	Yellowtail	0.000075	2.539
Copper	0.000011	3.099	Dark	0.000047	2.729
Dusky	0.000039	2.737	Other pelagic	0.000084	2.559
Quillback	0.000033	2.820	Other demersal	0.000025	2.892
Rougheye	0.000010	3.103	Other slope	0.000037	2.726
Shortraker	0.000048	2.724			
Yelloweye	0.000024	2.902			

Preliminary Estimation of Release Mortality Biomass

To achieve Secondary Objective 12b, the biomass of the rockfish harvest and release mortality must be estimated. Release mortality rates are defined as the proportion of released fish that die in the short term as a result of injuries associated with capture, handling, and release. Like the preliminary estimate of the harvest biomass, preliminary estimates of release mortality biomass, or just simply release biomass $\widehat{RB}_{sh}$, will be calculated as the sum of the individual mortality biomass estimates by each of the DSR species within each user group and across the corresponding ports. The overall variance will similarly be obtained by summation across the species, port, and user group values.

Release mortality biomass is based on the product of the estimated average weight of a species by user group $\overline{w}_{sh}$, the estimated discard mortality rate $\hat{d}_{sh}$, and the estimated number of fish of that species released by user group $\hat{R}_{sh}$. The average weight by species by user group is estimated by this project using Equations 25–33 from harvested fish and it is assumed that they represent released fish. Discard mortality rates are based on the fisheries literature. Rates differ by user group because all nonpelagic rockfish released by guided anglers are required to be released using a deep-water release (recompression) device. Nonguided anglers are currently not required to release rockfish using deep-water release devices and their release mortality rate is assumed to be 100%. The number of releases of a species is not observable by technicians and comparisons of creel and logbook data indicate that releases are not always captured in creel interviews. So, for both guided and unguided anglers, the release rate by species or species grouping ($\hat{r}_s$) will be the maximum of either the value from charter logbooks or creel data. The estimated number of releases will be determined as follows:

$$\hat{R}_{sh} = \widetilde{H}_{sh}\frac{\hat{r}_s}{1-\hat{r}_s}. \tag{57}$$

This equation is derived by solving the equation for release rate (r) below for number of releases (R) and observed harvest (H):

$$\hat{r}_s = \frac{R_s}{H_s+R_s}. \tag{58}$$

The variance of $\hat{R}_{sh}$ will be calculated as the product of variances via Goodman's equation (1960). The variance of $\frac{\hat{r}_s}{1-\hat{r}_s}$ will be simulated via bootstrapping as outline in Efron and Tibshirani (1993):

$$V(\hat{R}_{sh}) = (\tilde{H}_{sh})^2 V\left(\frac{\hat{r}_s}{1-\hat{r}_s}\right) + V(\tilde{H}_{sh})\left(\frac{\hat{r}_s}{1-\hat{r}_s}\right)^2 - V(\tilde{H}_{sh})V\left(\frac{\hat{r}_s}{1-\hat{r}_s}\right). \tag{59}$$

Release mortality biomass $\widehat{RB}_{sh}$ by species or species grouping and user group will be estimated as follows:

$$\widehat{RB}_{sh} = \bar{w}_{sh}\hat{d}_{sh}\hat{R}_{sh} \tag{60}$$

Variance of $\widehat{RB}_{sh}$ will be found by iteratively using Goodman's equation (1960). The variance of the $\bar{w}_{sh}\hat{d}_{sh}$ product is found first:

$$V(\widehat{wd}_{sh}) = (\bar{w}_{sh})^2 V(\hat{d}_{sh}) + V(\bar{w}_{sh})(\hat{d}_{sh})^2 - V(\bar{w}_{sh})V(\hat{d}_{sh}). \tag{61}$$

Then the release biomass variance $V(\widehat{RB}_{sh})$ is determined by finding the variance of the $\widehat{wd}_{sh}\hat{R}_{sh}$ product:

$$V(\widehat{RB}_{sh}) = V(\widehat{wd}_{sh}\hat{R}_{sh}) = (\widehat{wd}_{sh})^2 V(\hat{R}_{sh}) + V(\widehat{wd}_{sh})(\hat{R}_{sh})^2 - V(\widehat{wd}_{sh})V(\hat{R}_{sh}) \tag{62}$$

Age, Sex, and Length Composition of Black Rockfish (Primary Objective 6)

Estimates of age, and sex and length will be calculated using Equation 25 with variance calculated using Equation 29.

Weekly Harvest per Unit Effort of Chinook, Coho, Chum, and Pink Salmon, and Pacific Halibut (Secondary Objective 5)

Values of HPUE will be calculated as unweighted means because the objectives are primarily directed at providing information as a measure of the hours necessary to harvest the species in question (Secondary Objective 5). This objective is directed at providing information to the stakeholders involved, which are the general angling public. The measures of HPUE are summarized as weekly values (Secondary Objective 5) and the impact from not weighting is expected to be relatively minor, although the validity of this assumption will be evaluated during the postseason data analysis. The calculation process for the unweighted HPUE values first involves obtaining the mean HPUE for all rods fished in each interviewed boat party (creel samples only):

$$\overline{HPUE}_{hijk} = \frac{N_{hijk}}{e_{hijk}v_{hijk}} \tag{63}$$

where N_{hijk} is as defined previously (see Equation 5), e_{hijk} is the targeted[29] effort (boat-hours) of each interviewed boat party, and v_{hijk} is the targeted number of rods fished by the interviewed boat party.

[29] Boat-hours are recorded as fishing for salmon versus fishing for groundfish. The HPUE for Chinook and coho salmon will be calculated using the "salmon-hours" and the HPUE for halibut will use the "groundfish-hours."

Then, the mean HPUE for each week will be obtained over all boat parties interviewed within each of the corresponding periods:

$$\overline{HPUE}_p = \frac{\sum_{h=1}^{L}\sum_{i=1}^{d_p}\sum_{j=1}^{q_i}\sum_{k=1}^{b_{hij}} \overline{HPUE}_{hijk}}{\sum_{h=1}^{L}\sum_{i=1}^{d_p}\sum_{j=1}^{q_i} b_{hij}} \tag{64}$$

where all terms are as defined previously in this plan (however, d_p is defined as only including the days sampled within each corresponding period p). Because these values are used informational purposes only, the mean HPUE estimates will be calculated without corresponding estimates of the variance.

Proportion of Pacific Halibut Harvested by Unguided Anglers Prior to Mean IPHC Survey Date (Secondary Objective 8)

The proportion of the Pacific halibut harvested by unguided anglers prior to the mean IPHC survey date will be as follows for each port (or combined port):

$$\hat{p}_{u(d<\overline{ID})} = \frac{\hat{N}_{u(d<\overline{ID})}}{\left(\hat{N}_{u(d<\overline{ID})} + \hat{N}_{u(d\geq\overline{ID})}\right)} \tag{65}$$

where $\hat{p}_{u(d<\overline{ID})}$ is the proportion of the halibut harvest index for the unguided component[30] of the fishery for the date d less than the mean IPHC survey date ($\overline{ID}$), $\hat{N}_{u(d<\overline{ID})}$ is the harvest index using <u>creel samples only</u> for the unguided component prior to the mean IPHC survey date (as previously noted the mean date will be provided by IPHC) at each port by using Equation 26 on this restricted data set, and $\hat{N}_{u(d\geq\overline{ID})}$ is the unguided harvest index for dates greater than or equal to the mean IPHC survey date (again from Equation 26 on those restricted dates). The variance of $\hat{p}_{u(d<\overline{D})}$ will be calculated approximately as (adapted from Mood et al. 1974):

$$\hat{V}\left[\hat{p}_{u(d<\overline{ID})}\right] \approx \frac{\left(\hat{N}_{u(d<\overline{ID})} + \hat{N}_{u(d\geq\overline{ID})}\right)^2 \hat{V}\left[\hat{N}_{u(d\geq\overline{ID})}\right] + \hat{N}^2_{u(d\geq\overline{ID})}\,\hat{V}\left[\hat{N}_{u(d<\overline{ID})}\right]}{\left(\hat{N}_{u(d<\overline{ID})} + \hat{N}_{u(d\geq\overline{ID})}\right)^4} \tag{66}$$

where the corresponding variance terms are calculated from Equation 27 on the 2 sets of data restricted by date.

The survey dates at each port are expected to cover the most, but not all, of the unguided halibut harvest. Accordingly, the proportions estimated by Equation 65 may be slightly biased.

Yearly Midseason Projection of Preliminary Lingcod and Yelloweye Rockfish Harvested (Secondary Objective 10)

A midseason (through the beginning of August) projection of the annual yearly preliminary harvest of lingcod and yelloweye rockfish associated with the SWHS Survey Areas covered by the ports of Sitka, Ketchikan, Craig-Klawock, Gustavus, Elfin Cove, and Yakutat will be made by the

[30] The subscript *u* represents unguided and does not reference the tag code terms *U* or *u* as referenced previously in this plan in Equation 38.

procedures outlined in the **Midseason Projections** section above. The weekly summaries of lingcod and yelloweye rockfish harvest will be summed through August 2 and compared to a similar sum from past years. This comparison will be used to evaluate whether or not the total harvest of yelloweye rockfish and lingcod will be greater or less than in recent years.

Estimates of the Proportion for Chinook Salmon, Rockfish, Pacific Halibut, and Lingcod (Secondary Objective 7, 13, 14)

The proportion of catch of Chinook salmon (both <28 in TL and ≥28 in TL), rockfish (yelloweye, other DSR, slope, and pelagic), halibut, and lingcod released by the sport fishery at each port (or combined port within a SWHS Survey Area, secondary objective 14) will be calculated as outlined above for the intrinsic 4-stage cluster estimating equations using a coded version of the observed catch from <u>creel samples only</u>. Specifically, each fish reported caught (both the harvest and the reported number of fish released) by species or species grouping for each interviewed boat party will be coded as a "1" for a released fish, and a "0" for a harvested (kept) fish, per Equation 2. Then these coded values will be used in Equation 25 to obtain the estimated proportion of fish released. The corresponding variance will be calculated by substituting the coded values into Equation 29. Across–user group overall estimates of the proportion released and the associated variance will then be calculated per Equations 32 and 33. In applying Equations 25, 29, 32, and 33, both the 4-stage cluster sampling weights and the stratum weights will be calculated using the numbers of fish for each species or species group that were <u>caught</u> (including numbers harvested, plus number released) instead of the numbers harvested. So the numbers caught (c_{hijk}) will be substituted for the n_{hijk} terms in these equations. Logbook data is used to calculate release percentage for rockfish biomass estimates.

The proportion of released halibut by reverse slot limit category (secondary objective 7) will be calculated using the same 4-stage equations noted above calculating each of the 3 groups separately: a) length ≤ lower slot, b) length between lower and upper slots, c) length ≥ upper slot and coded as "1" in release category, and "0" not in release category. Only creel technician data will be used as catch technicians do not record releases.

The proportion of unguided vessels that utilize a deep-water release device (secondary objective 13) for at least one released rockfish on a given trip will also be calculated using the same 4-stage equations noted above coded as "1" for device used and "0" for device not used. Only creel technician trips where rockfish are released and where the technician noted they asked the anglers if they utilized a device or not will be included.

SCHEDULE AND DELIVERABLES

Field activities associated with surveying the marine boat sport fisheries will occur from 29 April to 15 September 2019. Weekly summaries of harvest rates will be produced for the 2014–2018 seasons and will be posted on the Division of Sport Fish website.

Data editing and analysis activities will be initiated in early May each year. Projections of treaty Chinook salmon harvests will be made 2 times. The inseason estimate of the treaty Chinook salmon harvest will be an inseason projection produced yearly the first week of August for use in helping manage the commercial fisheries to obtain the overall Pacific Salmon Treaty quota for Southeast Alaska

During August-September, after the latest SWHS final numbers are produced, staff will calculate the mean 5-year expansion factor values from the Marine Harvest Studies Project to the SWHS by port for estimates of the current years preliminary SWHS values.

Final error correction, reduction, and analysis of each year's survey data will be completed by the third week of October. Postseason preliminary estimates of the SEAK harvest of Chinook and coho salmon for the season will be produced by the end of October each year.

All cinch-strapped salmon heads will be submitted to the Tag Lab by the end of September each year. Final decoding of the tag recoveries for CWT-tagged salmon will be completed by mid-October each year. Contribution estimates to the fisheries will be completed by early November each year.

All Pacific halibut length data will be corrected by the first of October each year. Mean weight estimates and estimated proportion of unguided harvest prior to the mean IPHC survey date will be provided by the second week of October each year. Scales from Chinook salmon will be read by the following mid-January each year. Age composition and length-at-age estimates for Chinook salmon will be produced by the following mid-February each year.

All the Chinook salmon genetic samples collected during the creel survey season will be sent to the ADF&G, CF Gene Conservation Laboratory by early October each year. Information on the age composition of the sampled Chinook salmon will be provided to the ADF&G, CF Gene Conservation Laboratory by the following mid-February each year. Report writing will be initiated in early December each year and a draft report will be provided by November each following year. The draft report will document the yearly preliminary values associated with each of the objectives for this project at that time. Following the completion of final estimates from the SWHS for each of the years, anticipated by August-September, a draft report for this project will be updated to include final estimates for each of this project's objectives. The final draft will be submitted for regional review, followed by submission for publication as an ADF&G Fishery Data Series Report.

The deliverable products along with milestone dates are summarized in Table 8, with additional details.

The computer files associated with analyzing the creel survey data (e.g., the SAS data and program files, and auxiliary files) will be archived when the report is finalized (see Appendix B). A draft operational plan for the 2020 field season will be produced by 18 March 2020.

Table 8.–Yearly deliverable product schedule for the Southeast Alaska Marine Boat Sport Fishery Harvest Studies project in 2019.

When	Product	To whom	Title
May–early July	DCF Salmon Districts 108 & 111 wild Chinook salmon harvest estimates	Ed Jones	Fish and Game Coordinator
August 1	Projected Chinook salmon harvest prior to summer 2 commercial troll opening	Grant Hagerman and Judy Lum	Comm. Fish Troll Biologist & Region 1 Supervisor
Early August	Midseason preliminary projections of rockfish and lingcod harvest in outside districts	Bob Chadwick	Region 1 Management Coordinator
Mid October	Preliminary projected postseason Chinook harvest & CWT info	Grant Hagerman and Judy Lum	Comm. Fish Troll Biologist & Region 1 Supervisor
Mid October	Preliminary projected inseason coho salmon harvest	Leon Shaul & Judy Lum for PSC	Comm. Fish Coho Biologist & Region 1 Supervisor
Mid October	Average halibut weights, proportion of unguided harvest prior to mean IPHC survey date.	Sarah Webster & IPHC	Statewide Groundfish Coordinator – Division of Sport Fish
October	Average DSR weights & total biomass removal estimates (harvest and release)	Bob Chadwick & Andrew Olson	Region 1 Management Coordinator & Comm. Fish Groundfish manager
Mid November	Final projected inseason coho harvest	Leon Shaul & Judy Lum for PSC	Comm. Fish Coho Biologist & Region 1 Supervisor
November	Biweekly sampling rate	Sara Gilk-Baumer	ADF&G, DCF Gene Conservation Laboratory coordinator
January (of following year)	Average lingcod weights & biomass harvest estimates	Bob Chadwick	Region 1 Management Coordinator
January (of following year)	Age composition of Chinook salmon stocks	Ed Jones	Fish and Game Coordinator
November (of following year)	Draft FDS report for project incorporating SWHS estimates	Jeff Nichols	Region 1 Regional Research Coordinator

RESPONSIBILITIES

Michael Jaenicke, Fishery Biologist III

Duties: Coordinates all aspects of the project. Assists biometrician with study design and schedule generation. Performs and coordinates data analyses in conjunction with biometrician. Lead author of final report and provides inseason data to appropriate personnel. Provides support and advice to direct supervisors of the project personnel.

Diana Tersteeg, Research Analyst II

Duties: Performs data analyses in conjunction with project leader and biometrician. Responsible for oversight of continued development and maintenance of the handheld computer data entry software and SQL database. Design and write programs or queries using various statistical software packages such as SAS or database programs. Create statistically valid reports and technically detailed tables and figures necessary to meet the annual reporting requirements of the program. Provides assistance with operational planning and report writing.

Matt Catterson (Yakutat), Dan Teske (Juneau), Patrick Fowler (Petersburg-Wrangell), Craig Schwanke (Craig-Klawock), and Kelly Reppert (Ketchikan), Fishery Biologist III

Duties: Performs day-to-day oversight, supervision, and logistics of onsite creel sampling personnel at local port(s). Coordinates shipment of heads and data to Juneau office.

David Love (Juneau), Jason Pawluk (Sitka), Fishery Biologist II

Duties: Performs day-to-day oversight, supervision, and logistics of onsite creel sampling personnel at Juneau, Gustavus, and Elfin Cove (Love) and Sitka (Pawluk).

Vacant, Fish and Wildlife Technician IV.

Duties: In Ketchikan performs day-to-day oversight, supervision, and logistics of onsite creel sampling personnel at Ketchikan. Coordinates shipment of heads and data to Juneau office.

Jake Wieliczkiewicz, Adam Lake, Vacant Fish and Wildlife Technician III,

Duties: As crew leader in Sitka, Juneau, and Ketchikan helps supervise and train creel survey personnel in addition to checking and editing data. Coordinates shipment of heads and data to Mark Tag and Age Lab, assist in schedule generation, derby sampling, and other office activities.

Jiaqi Huang, Biometrician II

Duties: Provides input in sampling design and allocation, and designs scheduling procedures and incorporates into operational plan. Provides procedures for calculation of estimates and standard errors. Assist in report writing. Also reviews operational plan and final report.

Bruce Kruger, Mary Jo Lord-Wild, and Jay Kingery, Fish and Wildlife Technician III

Duties: Conduct catch sampling in remote locations as schedule dictates and provide summaries of data on a weekly basis. In addition, notes potential sampling problems and advise on possible solutions.

Fish and Wildlife Technician II's and III's

Duties: Conduct creel or catch sample surveys as schedule dictates and provide summaries of data on a weekly basis.

REFERENCES CITED

Bernard, D. R., and J. E. Clark. 1996. Estimating salmon harvest with coded-wire tags. Canadian Journal of Fisheries and Aquatic Sciences 53:2323–2332.

Clark, W. G. 1992. Validation of the IPHC length-weight relationship for halibut. Pages 113–116 *in* Report and Assessment of Research Activities, 1991. International Pacific Halibut Commission, Seattle, WA.

Clutter, R., and L. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Bulletin of the International Pacific Salmon Fisheries Commission, No. 9.

Efron, B., and R. J. Tibshirani. 1993. An introduction to the bootstrap. Chapman Hall, New York.

Goodman, L.A. 1960. On the exact variance of a product. Journal of the American Statistical Association 66:608–713.

Meyer, S. C. 2014. Estimation and projection of statewide halibut harvest. Alaska Department of Fish and Game, Division of Sport Fish, Regional Operational Plan ROP SF.4A.2014.08, Anchorage.

Mood, A. M, F. A. Graybill, and D. C. Boes. 1974. Introduction to the Theory of Statistics, third edition. McGraw-Hill, New York.

Nielsen, L. A., and W. F. Schoch. 1980. Errors in estimating mean weight and other statistics from mean length. Transactions of the American Fisheries Society 109:319–322.

Schwan, M. 1984. Recreational fisheries of Southeast Alaska, including Yakutat: an assessment. Alaska Department of Fish and Game, Juneau.

Suchanek, P. M., S. H. Hoffman, R. E. Chadwick, D. E. Beers, T. E. Brookover, M. W. Schwan, R. P. Ericksen, R. E. Johnson, B. J. Glynn, and B. J. Frenette. 2002. Area management report for the sport fisheries of Southeast Alaska, 2000. Alaska Department of Fish and Game, Fishery Management Report No. 02-04, Anchorage.

Sukhatme, P.V., B. V. Sukhatme, S. Sukhatme, and C. Asok. 1984. Sampling theory of surveys with applications, third edition. Iowa State University Press and Indian Society of Agricultural Statistics, Ames, Iowa.

Unpublished ADF&G, Sport Fish Division manuscript: 2019 Southeast Alaska Marine Harvest Studies Creel Technician Manual, ADF&G, Sport Fish Division, Juneau, Alaska

Welander, A. D. 1940. A study of the development of the scale of the Chinook salmon (*Oncorhynchus tshawytscha*). Master's thesis, University of Washington, Seattle.

APPENDIX A: ESTIMATES OF HARVEST AND RELATIVE PRECISION AND SAMPLE SIZE GOALS

Appendix A1.–Sample size and relative precision for Chinook and coho salmon projected total harvest in 2018 and goals for 2019 by port (Objective 1a and 2a).

Area	Species	Harvested Fish Encountered	Harvested Fish Inspected for Adclips	2018 Harvest Estimate RP[a]	2019 RP Goal
Ketchikan	Chinook	700	620	43%	50%
	coho	5,351	4,301	32%	50%
Craig-POW	Chinook	1,409	1,397	22%	50%
	coho	12,110	12,087	31%	50%
Petersburg/Wrangell	Chinook	164	158	52%	50%
	coho	233	211	52%	50%
Sitka	Chinook	2,850	1,854	18%	50%
	coho	23,800	14,000	21%	50%
Juneau	Chinook	433	345	29%	50%
	coho	5,012	4,153	37%	50%
Glacier Bay	Chinook	284	257	38%	50%
	coho	2,526	2,342	40%	50%
Yakutat	Chinook	148	128	133%	100%
	coho	1,017	1,006	135%	100%
District 108	Chinook	3	3	–[b]	–[b]
District 111	Chinook	311	246	30%	50%

[a] RP = Relative Precision for 90% Confidence Interval

[b] Relative Precision is not reported for harvests < 100 fish

Appendix A2.–Relative precision for Chinook and coho salmon projected total contribution (AK Hatchery and Non-AK Hatchery) observed in 2018 and goals for 2019 by port (Objective 1b and 2b).

Area	Species	2018 AK Hatchery Total Contribution RP[a]	2019 AK Hatchery Total Contribution RP Goal	2018 Non-AK Hatchery Total Contribution RP	2019 Non-AK Hatchery Total Contribution RP Goal
Ketchikan	Chinook	67%	80%	75%	80%
	coho	44%	50%		
Craig-POW	Chinook	48%	60%	38%	50%
	coho	34%	60%	– [b]	– [b]
Petersburg/Wrangell	Chinook	104%	100%	137	– [b]
	coho	74%	90%	– [b]	– [b]
Sitka	Chinook	41%	60%	35%	50%
	coho	24%	50%	– [b]	– [b]
Juneau	Chinook	46%	60%	– [b]	– [b]
	coho	46%	60%	– [b]	– [b]
Glacier Bay	Chinook	123%	100%	66%	80%
	coho	57%	70%	– [b]	– [b]
Yakutat	Chinook	– [c]	– [c]	– [b]	– [b]
	coho	– [c]	– [c]	– [b]	– [b]
District 108	Chinook	– [b]	– [b]	– [b]	– [b]
District 111	Chinook	%	60%	– [b]	– [b]

[a] RP = Relative Precision for 90% Confidence Interval

[b] Relative Precision is not reported for harvests < 100 fish

[c] Hatchery Contribution in Yakutat is not estimated and therefore there is no goal for Relative Precision

Appendix A3.–Precision for Chinook and coho salmon relative contribution (AK Hatchery and Non-AK Hatchery) observed in 2018 and goals for 2019 by port (Objective 1b and 2b).

Area	Species	2018 AK Hatchery Relative Contribution Precision[a]	2019 AK Hatchery Relative Contribution Precision Goal	2018 Non-AK Hatchery Relative Contribution Precision[a]	2019 Non-AK Hatchery Relative Contribution Precision Goal
Ketchikan	Chinook	11%	15%	6%	10%
	coho	7%	10%	–[b]	–[b]
Craig-POW	Chinook	7%	10%	8%	10%
	coho	13%	15%	–[b]	–[b]
Petersburg/Wrangell	Chinook	22%	25%	–[b]	–[b]
	coho	9%	10%	–[b]	–[b]
Sitka	Chinook	6%	10%	4%	5%
	coho	6%	10%	–[b]	–[b]
Juneau	Chinook	28%	30%	–[b]	–[b]
	coho	5%	10%	–[b]	–[b]
Glacier Bay	Chinook	19%	20%	10%	10%
	coho	10%	10%	–[b]	–[b]
Yakutat	Chinook	–[c]	–[c]	–[b]	–[b]
	coho	–[c]	–[c]	–[b]	–[b]
District 108	Chinook	–[b]	–[b]	–[b]	–[b]
District 111	Chinook	%	25%	–[b]	–[b]

[a] Absolute Precision for 90% Confidence Interval

[b] Precision is not reported for harvests < 100 fish

[c] Hatchery Contribution in Yakutat is not estimated

Appendix A4.–Sample size and relative precision for Pacific halibut mean weight in 2018 and goals for 2019 by port and angler class.

Port	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Ketchikan	Private	1164	16%	73%	20%	50%
Craig_Klawock	Private	259	18%	24%	20%	20%
Petersburg	Private	693	18%	71%	20%	50%
Wrangell	Private	153	21%	85%	25%	100%
Sitka	Private	128	36%	13%	35%	15%
Juneau	Private	1079	15%	45%	15%	50%
Gustavus	Private	261	21%	42%	25%	30%
Elfin Cove	Private	432	18%	75%	25%	50%
Yakutat	Private	223	21%	32%	25%	40%
Ketchikan	Charter	732	18%	85%	25%	50%
Craig_Klawock	Charter	662	7%	24%	10%	20%
Petersburg	Charter	135	17%	90%	25%	50%
Wrangell	Charter	40	19%	87%	20%	100%
Sitka	Charter	1333	7%	17%	10%	15%
Juneau	Charter	409	17%	57%	20%	50%
Gustavus	Charter	777	10%	47%	15%	30%
Elfin Cove	Charter	642	12%	63%	15%	50%
Yakutat	Charter	741	8%	39%	10%	40%

Appendix A5.–Sample size and relative precision for lingcod mean weight in 2018 and goals for 2019 by port and angler class.

Port	Angler Class	2018: Number of Fish Sampled	2018: Confidence Interval	2018: Relative Precision	2018: Percent Sampled of Observed Harvest	2019: Confidence Interval	2019: Relative Precision Goal for set CI	2019: Sampling Goals
Ketchikan	Private	127	80	17%	88%	80	20%	100%
Craig_Klawock	Private	198	80	11%	83%	80	10%	90%
Sitka	Private	71	80	19%	60%	80	20%	75%
Gustavus	Private	-	80	-	-	80	-	100%
Elfin Cove	Private	32	80	35%	71%	80	35%	100%
Yakutat	Private	45	80	22%	96%	80	25%	100%
Ketchikan	Charter	90	90	22%	90%	90	25%	100%
Craig_Klawock	Charter	669	90	11%	88%	90	10%	90%
Sitka	Charter	322	90	10%	56%	90	10%	75%
Gustavus	Charter	40	90	19%	95%	90	20%	100%
Elfin Cove	Charter	100	90	18%	84%	90	20%	100%
Yakutat	Charter	154	90	15%	92%	90	15%	100%

Appendix A6.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Ketchikan area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Ketchikan	Quillback rockfish	Private	415	13%	76%	20%	40%
Ketchikan	Copper rockfish	Private	154	21%	93%	25%	100%
Ketchikan	Yelloweye rockfish	Private	223	18%	79%	25%	50%
Ketchikan	China rockfish	Private	7	23%	88%	-	100%
Ketchikan	Tiger rockfish	Private	18	31%	72%	30%	100%
Ketchikan	Canary rockfish	Private	4	14%	100%	-	100%
Ketchikan	Rosethorn rockfish	Private	-	-	-	-	100%
Ketchikan	Dusky rockfish	Private	64	36%	67%	40%	100%
Ketchikan	Black rockfish	Private	100	34%	71%	35%	80%
Ketchikan	Quillback rockfish	Charter	360	13%	79%	20%	40%
Ketchikan	Copper rockfish	Charter	81	26%	69%	30%	100%
Ketchikan	Yelloweye rockfish	Charter	124	29%	83%	40%	50%
Ketchikan	China rockfish	Charter	15	33%	94%	35%	100%
Ketchikan	Tiger rockfish	Charter	10	25%	59%	-	100%
Ketchikan	Canary rockfish	Charter	8	39%	100%	-	100%
Ketchikan	Rosethorn rockfish	Charter	1	0%	100%	-	100%
Ketchikan	Dusky rockfish	Charter	22	47%	27%	50%	100%
Ketchikan	Black rockfish	Charter	600	28%	93%	30%	80%

Appendix A7.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Prince of Wales Island (Craig_Klawock) area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Craig_Klawock	Quillback rockfish	Private	57	17%	59%	20%	60%
Craig_Klawock	Copper rockfish	Private	24	21%	80%	25%	100%
Craig_Klawock	Yelloweye rockfish	Private	180	18%	81%	20%	75%
Craig_Klawock	China rockfish	Private	3	20%	100%	-	100%
Craig_Klawock	Tiger rockfish	Private	2	25%	100%	-	100%
Craig_Klawock	Canary rockfish	Private	8	32%	80%	-	100%
Craig_Klawock	Rosethorn rockfish	Private	-	-	-	-	100%
Craig_Klawock	Dusky rockfish	Private	5	39%	100%	-	100%
Craig_Klawock	Black rockfish	Private	80	23%	12%	30%	10%
Craig_Klawock	Quillback rockfish	Charter	142	16%	70%	20%	60%
Craig_Klawock	Copper rockfish	Charter	138	20%	91%	20%	100%
Craig_Klawock	Yelloweye rockfish	Charter	365	17%	79%	20%	75%
Craig_Klawock	China rockfish	Charter	23	29%	92%	30%	100%
Craig_Klawock	Tiger rockfish	Charter	5	50%	100%	-	100%
Craig_Klawock	Canary rockfish	Charter	56	30%	98%	30%	100%
Craig_Klawock	Rosethorn rockfish	Charter	-	-	-	-	100%
Craig_Klawock	Dusky rockfish	Charter	2	45%	100%	-	100%
Craig_Klawock	Black rockfish	Charter	326	15%	7%	15%	10%

Appendix A8.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Petersburg area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Petersburg	Quillback rockfish	Private	5	35%	100%	-	100%
Petersburg	Copper rockfish	Private	-	-	-	-	100%
Petersburg	Yelloweye rockfish	Private	43	23%	100%	25%	100%
Petersburg	China rockfish	Private	-	-	-	-	100%
Petersburg	Tiger rockfish	Private	-	-	-	-	100%
Petersburg	Canary rockfish	Private	-	-	-	-	100%
Petersburg	Rosethorn rockfish	Private	-	-	-	-	100%
Petersburg	Dusky rockfish	Private	93	40%	100%	40%	100%
Petersburg	Black rockfish	Private	8	21%	100%	-	100%
Petersburg	Quillback rockfish	Charter	1	0%	100%	-	100%
Petersburg	Copper rockfish	Charter	-	.	.	-	100%
Petersburg	Yelloweye rockfish	Charter	23	22%	82%	25%	100%
Petersburg	China rockfish	Charter	-	-	-	-	100%
Petersburg	Tiger rockfish	Charter	-	-	-	-	100%
Petersburg	Canary rockfish	Charter	-	-	-	-	100%
Petersburg	Rosethorn rockfish	Charter	-	-	-	-	100%
Petersburg	Dusky rockfish	Charter	142	24%	85%	25%	100%
Petersburg	Black rockfish	Charter	7	76%	100%	-	100%

Appendix A9.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Wrangell area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Wrangell	Quillback rockfish	Private	12	31%	75%	30%	100%
Wrangell	Copper rockfish	Private	2	54%	50%	-	100%
Wrangell	Yelloweye rockfish	Private	18	35%	86%	35%	100%
Wrangell	China rockfish	Private	-	-	-	-	100%
Wrangell	Tiger rockfish	Private	-	-	-	-	100%
Wrangell	Canary rockfish	Private	-	-	-	-	100%
Wrangell	Rosethorn rockfish	Private	-	-	-	-	100%
Wrangell	Dusky rockfish	Private	4	37%	80%	-	100%
Wrangell	Black rockfish	Private	1	0%	100%	-	100%
Wrangell	Quillback rockfish	Charter	8	89%	100%	-	100%
Wrangell	Copper rockfish	Charter	9	43%	90%	-	100%
Wrangell	Yelloweye rockfish	Charter	3	18%	100%	-	100%
Wrangell	China rockfish	Charter	-	-	-	-	100%
Wrangell	Tiger rockfish	Charter	-	-	-	-	100%
Wrangell	Canary rockfish	Charter	-	-	-	-	100%
Wrangell	Rosethorn rockfish	Charter	-	-	-	-	100%
Wrangell	Dusky rockfish	Charter	16	113%	94%	100%	100%
Wrangell	Black rockfish	Charter	6	44%	100%	-	100%

Appendix A10.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Sitka area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Sitka	Quillback rockfish	Private	44	38%	45%	40%	35%
Sitka	Copper rockfish	Private	52	26%	66%	25%	100%
Sitka	Yelloweye rockfish	Private	62	35%	32%	35%	25%
Sitka	China rockfish	Private	-	-	-	-	100%
Sitka	Tiger rockfish	Private	1	0%	14%	-	100%
Sitka	Canary rockfish	Private	13	37%	45%	40%	100%
Sitka	Rosethorn rockfish	Private	-	-	-	-	100%
Sitka	Dusky rockfish	Private	9	66%	22%	-	100%
Sitka	Black rockfish	Private	92	33%	13%	35%	5%
Sitka	Quillback rockfish	Charter	135	20%	37%	20%	35%
Sitka	Copper rockfish	Charter	198	15%	45%	15%	100%
Sitka	Yelloweye rockfish	Charter	441	11%	30%	25%	25%
Sitka	China rockfish	Charter	28	28%	46%	30%	100%
Sitka	Tiger rockfish	Charter	11	22%	46%	25%	100%
Sitka	Canary rockfish	Charter	137	23%	40%	25%	100%
Sitka	Rosethorn rockfish	Charter	-	-	-	-	100%
Sitka	Dusky rockfish	Charter	101	31%	25%	30%	100%
Sitka	Black rockfish	Charter	844	11%	6%	10%	5%

Appendix A11.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Juneau area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Juneau	Quillback rockfish	Private	177	18%	84%	20%	100%
Juneau	Copper rockfish	Private	1	0%	25%	-	100%
Juneau	Yelloweye rockfish	Private	34	23%	67%	25%	100%
Juneau	China rockfish	Private	-	-	.	-	100%
Juneau	Tiger rockfish	Private	4	28%	100%	-	100%
Juneau	Canary rockfish	Private	3	31%	100%	-	100%
Juneau	Rosethorn rockfish	Private	-	-	.	-	100%
Juneau	Dusky rockfish	Private	225	22%	76%	25%	100%
Juneau	Black rockfish	Private	17	89%	40%	90%	100%
Juneau	Quillback rockfish	Charter	122	20%	70%	20%	100%
Juneau	Copper rockfish	Charter	4	66%	67%	-	100%
Juneau	Yelloweye rockfish	Charter	18	25%	82%	25%	100%
Juneau	China rockfish	Charter	-	-	-	-	100%
Juneau	Tiger rockfish	Charter	19	32%	83%	35%	100%
Juneau	Canary rockfish	Charter	-	-	-	-	100%
Juneau	Rosethorn rockfish	Charter	-	-	-	-	100%
Juneau	Dusky rockfish	Charter	681	13%	53%	15%	100%
Juneau	Black rockfish	Charter	8	37%	50%	-	100%

Appendix A12.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Gustavus area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Gustavus	Quillback rockfish	Private	14	88%	100%	90%	100%
Gustavus	Copper rockfish	Private	-	-	-	-	100%
Gustavus	Yelloweye rockfish	Private	7	14%	88%	-	75%
Gustavus	China rockfish	Private	3	15%	100%	-	100%
Gustavus	Tiger rockfish	Private	1	0%	100%	-	100%
Gustavus	Canary rockfish	Private	-	-	-	-	100%
Gustavus	Rosethorn rockfish	Private	-	-	-	-	100%
Gustavus	Dusky rockfish	Private	-	-	-	-	100%
Gustavus	Black rockfish	Private	2	0%	5%	-	50%
Gustavus	Quillback rockfish	Charter	47	31%	92%	30%	100%
Gustavus	Copper rockfish	Charter	-	-	-	-	100%
Gustavus	Yelloweye rockfish	Charter	82	33%	89%	35%	75%
Gustavus	China rockfish	Charter	20	36%	83%	35%	100%
Gustavus	Tiger rockfish	Charter	3	16%	100%	-	100%
Gustavus	Canary rockfish	Charter	4	24%	100%	-	100%
Gustavus	Rosethorn rockfish	Charter	-	-	-	-	100%
Gustavus	Dusky rockfish	Charter	26	74%	100%	75%	100%
Gustavus	Black rockfish	Charter	269	25%	49%	25%	50%

Appendix A13.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Elfin Cove area.

Site	Species	Angler Class	2018: Number of Fish Sampled	2018: Relative Precision for 90% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Elfin Cove	Quillback rockfish	Private	71	27%	91%	30%	75%
Elfin Cove	Copper rockfish	Private	7	94%	78%	-	100%
Elfin Cove	Yelloweye rockfish	Private	51	37%	100%	40%	80%
Elfin Cove	China rockfish	Private	9	45%	100%	-	100%
Elfin Cove	Tiger rockfish	Private	4	16%	100%	-	100%
Elfin Cove	Canary rockfish	Private	2	24%	100%	-	100%
Elfin Cove	Rosethorn rockfish	Private	-	-	-	-	100%
Elfin Cove	Dusky rockfish	Private	12	43%	15%	45%	100%
Elfin Cove	Black rockfish	Private	96	39%	20%	40%	20%
Elfin Cove	Quillback rockfish	Charter	171	16%	81%	20%	75%
Elfin Cove	Copper rockfish	Charter	21	32%	88%	35%	100%
Elfin Cove	Yelloweye rockfish	Charter	212	21%	92%	25%	80%
Elfin Cove	China rockfish	Charter	9	23%	90%	-	100%
Elfin Cove	Tiger rockfish	Charter	19	27%	83%	30%	100%
Elfin Cove	Canary rockfish	Charter	11	9%	100%	10%	100%
Elfin Cove	Rosethorn rockfish	Charter	-	-	-	-	100%
Elfin Cove	Dusky rockfish	Charter	55	31%	18%	30%	100%
Elfin Cove	Black rockfish	Charter	164	19%	6%	10%	20%

Appendix A14.–Sample size and relative precision for rockfish mean weight in 2018 and goals for 2019 by species and angler class in the Yakutat area.

Site	Species	Angler Class	2017: Number of Fish Sampled	2017: Relative Precision for 90% CI	2017: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 90% CI	2019: Sampling Goals
Yakutat	Quillback rockfish	Private	14	39%	88%	40%	100%
Yakutat	Copper rockfish	Private	18	27%	100%	30%	100%
Yakutat	Yelloweye rockfish	Private	5	0%	100%	-	100%
Yakutat	China rockfish	Private	3	18%	50%	-	100%
Yakutat	Tiger rockfish	Private	-	-	-	-	100%
Yakutat	Canary rockfish	Private	-	-	-	-	100%
Yakutat	Rosethorn rockfish	Private	-	-	-	-	100%
Yakutat	Dusky rockfish	Private	-	-	-	-	100%
Yakutat	Black rockfish	Private	22	71%	12%	70%	10%
Yakutat	Quillback rockfish	Charter	130	15%	89%	15%	100%
Yakutat	Copper rockfish	Charter	27	20%	96%	20%	100%
Yakutat	Yelloweye rockfish	Charter	43	39%	100%	40%	100%
Yakutat	China rockfish	Charter	26	21%	90%	20%	100%
Yakutat	Tiger rockfish	Charter	-	-	-	-	100%
Yakutat	Canary rockfish	Charter	-	-	-	-	100%
Yakutat	Rosethorn rockfish	Charter	-	-	-	-	100%
Yakutat	Dusky rockfish	Charter	14	22%	100%	25%	100%
Yakutat	Black rockfish	Charter	269	15%	12%	15%	10%

Appendix A15.–Sample size and relative precision/precision for black rockfish mean length and proportion by sex in 2018 and goals for 2019 by angler class in the Sitka area.

Site	Parameter	2018: Number of Fish Sampled	2018: Relative Precision for 95% CI	2018: Percent Sampled of Observed Harvest	2019: Relative Precision Goal for 95% CI	2019: Sampling Goals
Sitka	Length	936	12%	7%	15%	5%

Site	Parameter	2018: Number of Fish Sampled	2018: Precision for 95% CI	2018: Percent Sampled of Observed Harvest	2019: Precision Goal for 95% CI	2019: Sampling Goals
Sitka	Sex, Male	525	9%	4%	10%	5%
Sitka	Sex, Female	525	7%	4%	10%	5%
Sitka	Age_1: 1-8	562	6%	4%	10%	5%
Sitka	Age_2: 9-16	562	8%	4%	10%	5%
Sitka	Age_3: 17-24	562	7%	4%	10%	5%
Sitka	Age_4: 25-32	562	3%	4%	10%	5%
Sitka	Age_5: 33-40	562	1%	4%	10%	5%

APPENDIX B: EXAMPLE COMPUTER FILES AND DATA FLOW

Appendix B 1.–Computer data files, locations, and analysis programs developed for the 2019 Southeast Alaska marine boat sport fishery survey.

Data is stored in a relational database located on a Juneau ADF&G server: dfgjnusql-db04p under the database name of SF_MarineHarvest.

All analysis programs and SAS datasets are located on the network drive S:\creel\2019\2019 SAS files\Programs folder unless otherwise noted below.

File locations with SAS Library name in parentheses:

1. (SPSF) S:\creel\2019\2019 SAS files\PSF\
    a. Yearly effort and harvest files by site
2. (SPSF3) S:\creel\2019\2019 SAS files\PSF\EST_output\.
    a. Yearly estimated harvest files by site
3. (PSF) S:\creel\A_PSF_SAS datasets
    a. Final datasets by year – MSE and EST
    b. Multi-year harvest comparison files
    c. Multi-year effort (hours/days fished) files
    d. Rockfish release device data
4. (SAWL) S:\creel\2019\2019 SAS files\AWL
    a. Yearly biological files by site
5. (AWL) S:\creel\AWL_SAS datasets
    a. Final biological files by year
6. (AWL-PSF) S:\creel\2019\2019 SAS files\AWL_PSF
    a. Files combining AWL and MSE by year
7. (CAT) S:\creel\Catch_Rates_SAS datasets
    a. HPUE
8. (Catch_S) S:\Creel\A Catch Sampling CWT_SAS datasets
    a. Catch Sampling data
    b. Cwt counts
9. (CWT) S:\Creel\CWT_SAS datasets
    a. Data from the CF Tag Lab
10. (Logbook) S:\creel\Logbook_SAS datasets
    a. Charter logbook data
11. (Lookup) S:\creel\A_PSF_SAS lookup
    a. Area lookup cross reference files
12. (Mhs_Prod) mhs_prod odbc dsn=MHS_prod schema=dbo
    a. SQL database
13. (SWHS) S:\creel\SWHS Estimates_SAS datasets
    a. SWHS data in SAS format
    b. MHS-SWHS projections
14. (SPECLIST) S:\creel\A_PSF_SAS speclist
    a. List of species for EST to run
    b. These were historically in the SPSF library and remain there, either are fine to use in these cases. But these are not year specific, which is fine as you are just calling a group of species. Only an issue if need a specific group for a specific year.

Analysis Programs:

1. **Data_extract_from_SQL.sas**. Creel and catch data. Requires SAS 9.4
    a. Purpose: Pulls data from the SQL database and transforms to file setup required by SAS.
    b. Input: SQL database
    c. Output: SPSF.Target_input_18_site.sas8dat
    d. Output: SAWL.Biological_input_2019_all
    e. Output: S:\creel\2019\2019 SAS files\All Error Output\AWL forms**AWL_errors_2019_date.xlsx** (misc. sampling errors)
    f. Output: S:\creel\2019\2019 SAS files\All Error Output\PSF Forms**PSF_errors_2019_date.xlsx** (misc. interview errors)
    g. Output: S:\Creel\2019\2019 SAS files\PSF**Shift_rpt.xlsx** (list of all shifts transmitted)
    h. Notes: For 2019 had to rewrite everywhere it dealt with DE, data came in completely in 2019 where only partially in 2017.
    i. Notes: Need to filter in SQL first to only grab shifts in the current year to take processing time off of SAS at a minimum. Should be able to do other filtering/joining in SQL to further minimize SAS processing requirements
2. **AMS19.sas –** creel and catch data. Requires SAS 9.4
    a. Purpose: Only grabs creel data and starts analyzing data, and creates all datasets required by the EST program.
    b. Input: SPSF.Target_input_17_site
    c. Output: SPSF.X_site_2019_mc_mse, _msi, _mss (creel)
    d. Output: SPSF.X_site_2019_mcd_mse, _msi, _mss (catch)
    e. Output: SPSF.X_site_2019_mcb_mse, _msi, _mss (de)
    f. Output: PSF._2019_MSE_Logbook (creel)
    g. Output: PSF._2019_MSE_CC_Logbook (catch & de)
    h. Output: SPSF._2019_Chinook_sampling
    i. Note: 2019 incorporated program: Msi_merge.sas into AMS
    j. Output: PSF._&year._mc_msi (creel) and PSF._&year._mcd_msi (catch) and PSF._&year._mcb_msi (de)
    k. Output: S:\creel\2019\2019 SAS files\All Error Output\ PSF Forms\ **Error_MSA_year_site_mc/mcd_date.xlsx** (Error files)
    l. Output: S:\creel\2019\2019 SAS files\All Error Output\ PSF Forms**Missing_areas_date.xlsx** (records with missing areas)
3. **2019 Error_check_creel_interview_data_app.sas**
    a. Purpose: general error check and looks at illegal harvest
    b. Input: SPSF. X_site_2019_mc_mse
    c. Output: S:\creel\2019\2019 SAS files\ALL Error Output\PSI forms\ 0219_SE_error_check_alt_
4. **Derby_import_program_BW_SW.sas**
    a. Purpose: grab derby entered information
    b. Input: S:\Creel\A Catch Sampling CWT\Derby Entered Numbers_SW.xlsx
    c. Output: S:\Creel\A Catch Sampling CWT_SAS datasets\derby_entered.sas7bdat
5. **Logbook_import_2019.sas**
    a. Purpose: pulls in current checked out logbooks (have to have excel file open for SAS to import data).
    b. Input: S:\creel\Loogbook\Logbook Checkout\Logbook_2019.xls
    c. Output: SPSF.Logbook_2019

6. **Logbook_merge_2019_MSE.sas**
    a. Purpose: Merges creel dataset with Logbook checkout to verify numbers recorded are valid.
    b. Input: PSF._2019_MSE_logbook
    c. Output: S:\creel\2019\2019 SAS files\All Error output\PSI forms\SE_2019_MISSING_LB_&sysdate.xml"
7. **Cat18_macro_hpue_fds_wGAF.sas** (located in: S:\Creel\Catch_Rates\2019)
    a. Located in: S:\Creel\Catch_Rates\2019
    b. Purpose: Calculates HPUE
    c. Input: SPSF. X_site_2019_mc_mse
    d. Output: S:\Creel\Catch_Rates\2019\CAT19_boat_date.xlsx
    e. Output: S:\Creel\Catch_Rates_SAS datasets\X_xxx_2019_hpue.sas7bdat
8. **Five_yr_avg_HPUE_2013-2017_compare 2019.sas** (located in: S:\Creel\Catch_Rates_5 yr programs)
    a. Located in: S:\Creel\Catch_Rates_5 yr programs
    b. Purpose: Compares HPUE for each Site over last 5 years to current year
    c. Input: S:\Creel\Catch_Rates_SAS datasets\X_xxx_year_hpue.sas7bdat
    d. Output: S:\Creel\Catch_Rates\Multi Year\ SITE_HPUE_2012_2016_compare_2019
9. **A_CHEst19.sas**
    a. Purpose: Calculates estimated harvest index based on area and specific locations
    b. Input: SPSF.X_site_2019_mc_mse and SPSF.X_site_2019_mc_mss
    c. Output: SPSF3.X_site_2019_est_area
    d. Output: S:\creel\2019\2019 SAS files\PSF\EST_output\log files
10. **A_AWL19.sas**
    a. Purpose: pull in awl data and format and organize by spec group
    b. Input: SAWL.Biological_input_2019_all
    c. Output: SAWL.ALL_19_MC_AWL
    d. Output: SAWL.ALL_2019awl_KS_mc_01
    e. Output: SAWL.ALL_2019awl_ha_mc_01
    f. Output: SAWL.ALL_2019awl_lc_mc_01
    g. Output: SAWL.ALL_2019awl_rf_mc_01
    h. Output: SAWL.ALL_2019awl_sb_mc_01
    i. Output: S:\creel\2019\2019 SAS files\All Error Output\AWL forms**Bio_AWL_errors_date.xlsx** (awl errors)
    j. Added a % include statement at bottom so runs the below 5 species specific programs
    k. Added a % include to run the convert program to convert the xml files to xlsx.
11. **2019_Halibut_Port_ALL.sas** (called in A_AWL19.sas)
    a. Purpose: analyze SEAK halibut data
    b. Input: sawl.All_&cyear.awl_ha_mc_01
    c. Output: awl.SE_HA_&cyear._awl_logbook
    d. Output: creel/AWL/2019/Halibut/19_SE_AWL_LEN_WT_(DATE).xlsx

The below have similar purpose, input and output as Halibut run.

12. **2019_Chinook_Port_ALL.sas** (called in A_AWL19.sas)
13. **2019_Rockfish_Port_ALL.sas** (called in A_AWL19.sas)
14. **2019_Lingcod_Port_ALL.sas** (called in A_AWL19.sas)
15. **2019_Sablefish_Port_ALL.sas** (called in A_AWL19.sas)

16. **MHS_CWT_Sample_Numbers_w_DIT.sas** *– requires SAS 9.4 as uses ods excel. - this one takes a **while** to run and you cannot make changes to the database while it is running. Need to run right after running Data extract or will get records that may not match up since this one is run directly from the database.*
    a. Purpose: To grab CWT sample numbers from all files to report number sampled, checked for CWT, not clipped wanded, and number detected (takes a little while to run as accesses a database view).
    b. Purpose: Also added in an output looking at sampling percentages.
    c. Input: Mhs_prod.V_Rpt_CWTSamples – view contractors created (this is what takes so long to run (~15-20 min)– grabbing the view data. Look at getting this information from some other means possibly.
    d. Input: sawl.Biological_input_2019_all (from Data_extract_from_SQL_2019_v3.sas)
    e. Input: spsf.target_input_19_ALL (from Data_extract_from_SQL_2019_v3.sas)
    f. Input: cwt._2019_cwt_all2 (from TagLab_import_sport_report_V2b.sas)
    g. Output: catch_s.CWT_Report_2019
    h. Output: S:\creel\2019\2019 SAS files\CWT**_2019_CWT_Report_date.xlsx** (list of what will go to the tag lab (use this to check for unreleased heads, needs review=Y)).
    i. Output: S:\creel\2019\2019 SAS files\CWT**CWT_numSampled_&cyear.xlsx** (summary of all fish checked for cwt – with estimated harvest by biweek. Compare this to the CWT sport expansion report)
    j. Output: S:\creel\2019\2019 SAS files\ALL Error Output\CWT forms**Error_CWT_numSignaled_&cyear.xlsx** (signaled/not signaled errors)
    k. Output: S:\creel\2019\2019 SAS files\All Error Output\CWT forms**Error_CWT_numsampled_2019.xlsx** (finds errors where number wanded or checked for CWT or tag detected are incorrect or not filled in).
    l. Output: S:\creel\2019\Weekly Sampling Summaries**Sampling Percentage Summary_*year_date*.xlsx**
    m. Output: S:\creel\2019\2019 SAS files\All Error Output\AWL forms**biosamples without a target_date.xlsx** (records where tech noted sampled fish but none kept)
    n. Output: S:\creel\2019\2019 SAS files\All Error Output\PSF forms**Species in two different targetID_date.xlsx** (must adjust or area cannot be assigned)
17. **MHS_CWT_merge_TAGlab_CWT.sas –** *must run [16 and 43] before can run this file*
    a. Purpose: to merge creel and taglab data to look at interviews noted as detected and see if there was a tag or not.
    b. Input: catch_s.CWT_report_2019 (from MHS_CWT_Sample_Numbers_w_DIT_V5.sas);
    c. Input: cwt._2019_cwt_all2 (from TagLab_import_sport_report_V2b.sas)
    d. Output: S:\Creel\2019\2019 SAS files\CWT\CWT_MHS_tag_merge.csv

Average and Proportion Variance Equations

18. **AWL_Variance_V3_2019.sas**
    a. Purpose: to grab all biological data and variables required to calculate the 4th stage variance equations
    b. Input: awl.se_*species_year*_awl_logbook; PSF._*year*_mc_msi and mcd_msi
    c. Output: AWL_PSF.NumFMeas_4_V2_&yr

19. **EST_CHEst*YR*_avg_var_v12_alt.sas**
    a. Purpose: calculate weighted averages and associated variance.
    b. Input: spsf. *port*_15_mc_mse; spsf.*port*_15_mc_mss; AWL_PSF.*port*_CS_15_mse_hijk; AWL_PSF.*port*_CS_15_mss; AWL_PSF.NumFMeas_4_V2_&yr
    c. Output: S:\creel\2019\2019 SAS Files\AWL_PSF\Output\
        i. _year_BIO_WEIGHTED_MEAN_DATE.xlsx

        ii. _year_biological_sampling_precision_date.xlsx

    d. Notes: has code at start of program to narrow down the RF in the speclist to only include RF that had been caught in at least 1 port

20. **EST_CHEst15_prop_V6a.sas**
    a. Purpose: calculated proportions and associated variance
    b. Input: spsf.*port*_19_mc_mse; spsf. *port*_19_mc_mss; spsf. *port*_19_mc_msi; awl_psf.
    c. Output: awl_psf.SEAK_2019_prop_rel_all
    d. Output: awl_psf.SEAK_2019_prop_rel_rf
    e. Output: awl_psf.SEAK_2019_RF_comp_all
    f. Output: S:\Creel\&year.\&year. SAS files\AWL_PSF\Output\
        i. &year._weighted proportion released w_var_&sysdate..xlsx
        ii. &year._weighted rf composition w_var_&sysdate..xlsx
21. **A_CHEst_AWL_output_all.sas**
    a. Purpose: to pull together estimated harvest and SE and average and var by GF or LC_area if there are multiple sites per Area.
        i. Averages_2019_EST_AWL_merge_date.xlsx
        ii. Rockfish proportion composition
        iii. Release composition
    b. Input: psf._2019_est_bf_areas
    c. Input: psf._2019_est_all
    d. Input: awl_psf.SEAK_2019_ALL_AVG_*species*
    e. Output: S:\creel\2019\2019 SAS Files\AWL_PSF\Output\
        i. Averages: _2019_EST_AWL_merge_date.xlsx
        ii. Rockfish proportion composition: _2019_EST_Prop_merge_date.xlsx
        iii. Release composition: _2019_EST_PROP_rel_merge_date.xlsx
22. **Run R program** to combine data by SWHS_area, GF_area, or LC_area. Files located in S:\creel\2019\2019 SAS Files\AWL_PSF\Output and will output here too.
    a. Purpose: To take averages and proportions from all sites and SWHS, GF, and LC areas and pull them together running a simulation to get a weighted average or proportion and SE.
    b. Run the following with the associated files:
        i. Combining areas_dlt.r which calls: _2019_EST_AWL_merge_*date*.xlsx
        ii. Combining areas_prop_rel_alt_dlt.r which calls: _2019_EST_PROP_rel_merge_*date*.xlsx
        iii. Combining areas_prop_comp_alt_dlt.r which calls: _2019_EST_PROP_merge_*date*.xlsx
    c. Output from above: S:\creel\2019\2019 SAS Files\AWL_PSF\Output\
        i. Averages: Mean_Weight_Results_alt.csv
        ii. Release composition: Proportion_CombinedArea_rel_Results_alt.csv
        iii. Rockfish prop composition: Proportion_CombinedArea_RF_comp_Results_alt.csv
23. **R_import_data_join.sas**
    a. Purpose: to import the csv file that results from the R program to join the newly combined dat
    b. Output: S:\creel\2019\2019 SAS Files\AWL_PSF\Output\ _2019_EST_AVG_PROP_final_output_date.xlsx

Reporting Database Programs: under Reports

24. **Data_export_to_SQL_EST_2019.sas** (has macro to change year)
    a. Purpose: to export EST data to the database
    b. Input: PSF._year_EST_ALL.sas
    c. Output: SQL database

25. **Data_export_to_SQL_HPUE.sas** (macro to change year)
    a. Purpose: to export HPUE data to database
    b. Input: CAT.X_site_year_HPUE
    c. Output: SQL database

26. **MHS_Report_unlock.sas** (administrator usage only!)
    a. Purpose: to reflect what can and cannot be overwritten in the database

27. **Check_deleted_records.sas**
    a. Purpose: to look at deleted records
    b. Input: SQL schema=History
    c. Output: work file

Projection of Creel to SWHS

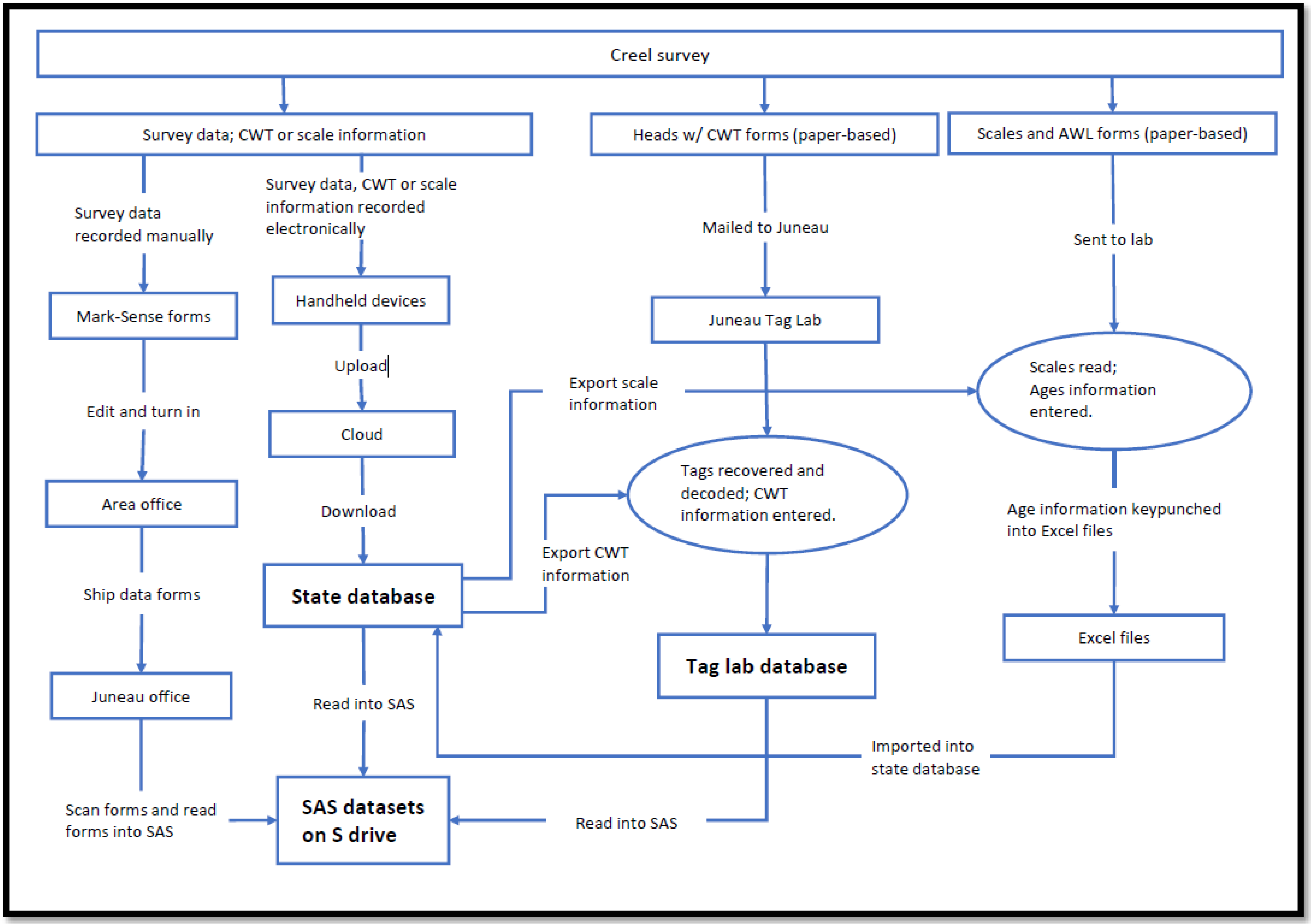
28. **SWHS_creel_projection_w_DE_V6b_2013-2017.sas (Located in S:\Creel\SWHS Estimates\SAS programs**
    a. Purpose – calculate expansion of creel data to SWHS data and project current years SWHS.
    b. Input: SWHS.final_&I._swhs_w_se, for requested years.
    c. Input: PSF._year_est_all,
    d. Input: PSF._year_est_subareas
    e. Input: AWL.Se_ks_year_awl_logbook
    f. Input: psf.derby_entered
    g. Input: swhs.expansion_factor_var_&syear._&eyear.
    h. Output: SWHS.ExpFactor_&syear._&eyear.
    i. Output: S:\creel\SWHS Estimates\MHS_SWHS projection\ project_&cyear._SWHS_from_creel_&syear.-&eyear._wDE_&sysdate..xlsx
    j. Output: S:\creel\SWHS Estimates\MHS_SWHS projection\for_R_&cyear._SWHS_creel_&syear.-&eyear._&sysdate..xlsx – this is output midway through program and then run in R
29. **Expansion factor Harvest.R** (Located in S:\Creel\SWHS Estimates\SAS programs\R script)
    a. Input:: S:\creel\SWHS Estimates\MHS_SWHS projection\for_R_&cyear._SWHS_creel_&syear.-&eyear._&sysdate..xlsx
    b. Output: Expansion Factor Harvest syear-eyear version 2.csv
30. **Expansion factor Catch.R** (Located in S:\Creel\SWHS Estimates\SAS programs\R script)
    a. Input: S:\creel\SWHS Estimates\MHS_SWHS projection\for_R_&cyear._SWHS_creel_&syear.-&eyear._&sysdate..xlsx
    b. Output: Expansion Factor Catch syear-eyear version 2.csv
31. **Expansion factor var import.sas** (Located in S:\Creel\SWHS Estimates\SAS programs\R script)
    a. Input: Expansion Factor Var Syear-Eyear.xlsx – cut and paste the output column desired from both R programs into this one spreadsheet for inport.

Additional Programs

32. **EST_Multi_YR_SUM_2019.sas** (Located in S:\Creel\A_PSF\SAS Programs)
    a. Purpose: Compares est output over last 5 years
    b. Input: PSF._&YR._est_all
    c. Output: S:\creel\A_PSF\Multi Year_&syear._&eyear._EST_Cum_&Vname._&spec._&sysdate..xml
33. **RF_Rel_Dev_by_Boat.sas**
    a. Purpose: quick look at use of deep water release device on vessels that released NPL rockfish
    b. Input: SPSF.Target_input_19_all (intermediate file)
    c. Output: S:\creel\A_PSF\Rockfish\Use of RF release device_2019

34. **TagLab_import_sport_report.sas** (Located in S:\Creel\CWT\). This program was updated in 2018 to account for changes to the Tag Lab database updates.
    a. Purpose: import TagLab sport report records into SAS
    b. Input: S:\creel\cwt\xxxx_sport_report_date.xlsx
    c. Output: cwt._year_cwt_all
35. **TagLab_import_number_sampled.sas** (Located in S:\Creel\CWT\).
    a. Purpose: import TagLab number sampled records into SAS
    b. Input: S:\creel\cwt\xxxx_number_sampled_date.xlsx
    c. Output: cwt._year_num_samp_all
36. **TagLab_import_number_sampled.sas** (Located in S:\Creel\CWT\).
    a. Purpose: import TagLab CWT sport expansion report into SAS
    b. Input: S:\creel\cwt\xxxx_sport_expansion_date.xlsx
    c. Output: cwt._year_cwt_exp_all
37. **SPRT_EXPANS19.XLS –** Data file from tag lab with sampling information for each biweekly period.
38. **SFCON19.XLS** - Data file from tag lab with recovery information for each adipose finclipped coho and Chinook salmon sampled.
39. **SEN19CWT.SAS** - SAS program to do basic contribution estimates.
40. **SEN19CO1.SAS** - SAS program to summarize contributions across tag codes for main tables.
41. **SEN19CWP.SAS** - SAS program to list tags, contributions, and variances for appendices.
42. **SEN19CW3.SAS** - SAS program to summarize contributions at ports with catch sampling programs

Appendix B2.–Illustration of the flow of data from data collection through archive.



Appendix B3.–Illustration of various parameter estimates are produced.